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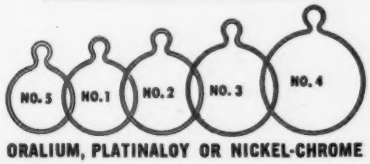

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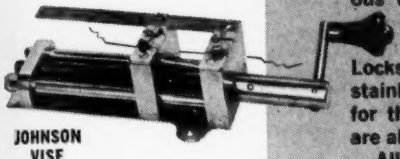

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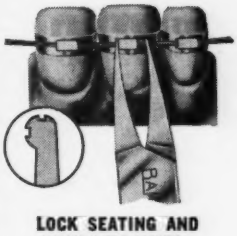

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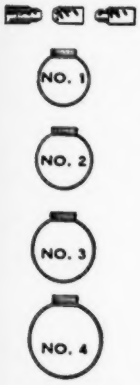

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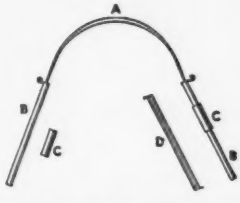

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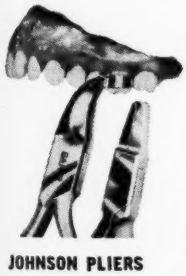

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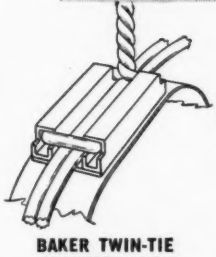

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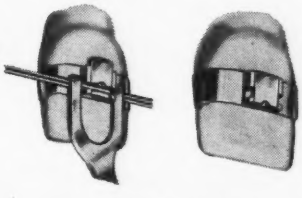

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VOL. 46 JUNE, 1960 No. 6

Original Articles

PRESIDENT'S ADDRESS, PACIFIC COAST SOCIETY OF ORTHODONTISTS

RICHARD M. RAILSBACK, D.D.S., PIEDMONT, CALIF.

WELCOME to the twenty-sixth biennial meeting of the Pacific Coast Society of Orthodontists. I fully realize that no one attends a meeting of this nature to listen to anything so dull as a president's address; however, since this is a customary part of the program, I'm afraid you will have to bear with me for a few moments.

At this time I wish to thank publicly the men and women who have worked so long and diligently in the planning and preparation of this meeting. It has taken many hours of their time, and I speak for all of them when I say that it is their sincere hope that you will enjoy the results of their efforts.

First of all, I wish to thank Dr. Eugene West, our program chairman. I feel that Gene has brought to us an outstanding group of essayists and clinicians, and I am sure that you will enjoy them.

Next I wish to thank the following committee chairmen and their committee members:

Local Arrangements and Equipment	Rodney Johnson
Reservations and Housing	Norman Snyder
Entertainment	Arthur Skaife
Limited Attendance and Table Clinics (assisted by Howard Lang from the Southern Component and Richard Reidel from the Northern Component)	Rodney Mathews
Registrations and Admissions	John Sibley
Commercial Exhibits	Glen Foor
Golf Tournament	Ray Lussier
Publicity	Seymore Gray

Presented at the twenty-sixth biennial meeting of the Pacific Coast Society of Orthodontists, Palo Alto, California, Feb. 22, 1960.

Last, but certainly not least, I want to mention the co-chairmen of the Ladies' Program, Arnold Wieser and Mrs. Norman Snyder.

I would like to also thank our hard-working and industrious secretary, Warren Kitchen, whose help and assistance have been invaluable to me. I wish also to thank William Smith for the fine job he is doing on our *Bulletin.*

I cannot overlook a word of commendation for one of our standing committees—the Membership Committee, which consists of George Hahn (chairman), William Smith of the Central Component, Emery Fraser and Malcolm Chipman of the Northern Component, and Herbert Muchnic and Harvey Spears of the Southern Component. The preceptorship program, if it is to be properly carried out as it has been by this committee, involves a tremendous amount of work. This committee, besides processing the various preceptor and preceptee applications by mail, have met twice in San Francisco during the past year in order to carry out their duties effectively. Also, they were in session here in Palo Alto all day Saturday, conducting examinations for seven preceptees. I can assure you that our preceptorship program is in good hands, and I feel that the contribution of this committee has been outstanding.

While I am on the subject of preceptorships, I would like to say that the program, as such, has served as an excellent stopgap until the time comes when our colleges can adequately supply us with well-trained men. It is my personal opinion that the preceptorship program can never equal the products of good teaching institutions, and I believe that within the next decade the program will be discarded by the American Association of Orthodontists.

At the present time there simply are not enough orthodontists to go around, particularly on the Pacific Coast. In our larger cities, and even in many of our smaller ones, it seems that most orthodontists have long waiting lists, and the general complaint is that they have more work than they can take care of. The population is increasing so rapidly on the Pacific Coast that I am very much afraid that the situation is going to become worse long before it becomes better. It is very gratifying to know that the University of Southern California is starting a graduate course in orthodontics this September. The University of California at Los Angeles has selected a dean, Dr. Reidar S. Sognnaes, for its new dental school, and I sincerely hope that eventually U.C.L.A. will also incorporate a course in orthodontics in their curriculum. I also hope that before too very long Harold Noyes will see fit to institute an orthodontic course at the University of Oregon and in some measure ease the pressure in the Pacific Northwest.

The fact seems very clear to me that the public not only accepts but demands our profession as an essential part of the general health services, and the only way to satisfy this increasing demand is through the production of more well-trained orthodontists.

Now for the functioning and future conduct of our own organization. In the past seven years our membership has grown from 218 members to a present total of 515 members; in other words, it has more than doubled. This increase in membership clearly illustrates the public's desire for orthodontic attention,

for I am firmly convinced that any astute orthodontic graduate would prefer to start his orthodontic career in an area where he is reasonably certain that there will be a demand for his services. In other words, men who graduate from our Pacific Coast schools remain in this area. Since it is common knowledge that orthodontists on the West Coast enjoy busy practices, graduates from other parts of the country are attracted to our area. I do not wish to refute my previous statements; we definitely need more orthodontists, but the point that I wish to emphasize is that our Pacific Coast Society has grown to the point where some thought and consideration must be given to its future.

First of all, the Society has pretty well outgrown the services which can be provided by a secretary who, in addition to the duties of this office, is also carrying on an active practice. Our secretary, Dr. Kitchen, has done an admirable job, but he needs help and it must be provided. I will not elaborate on this particular problem, as it will be adequately covered in Dr. Kitchen's report.

Another point that I wish to call to your attention is that in the past the director and alternate director who represent the Society at the annual meeting of the American Association of Orthodontists have been your president and your secretary. I have attended these meetings for the past three years, once as an alternate and twice as a director, and I have been surprised to find that most of the directors from the other constituent societies are not the presidents or the secretaries but men who are thoroughly familiar with the mechanics of the American Association of Orthodontists and elected to that position for a term of from two to four years. I was also somewhat surprised to find that the directors' traveling expenses and hotel accommodations incident to these meetings are underwritten by the constituent societies. Consequently, I have recommended to your Board of Directors that perhaps our Society should follow this pattern; the matter is now up for their consideration.

In closing, if I may be so bold as to forecast the future of our Pacific Coast Society, I am rather certain that in not too many years it may be necessary to break our group down into two or even three constituent societies to provide better organizational efficiency. This has been necessary in some of the eastern societies. Due to the increasing size of our membership and our wide geographic distribution, it may be an eventuality for our Society to consider. Certainly, this should provide our future officers and directors with some definite food for thought. We have a strong, progressive, and financially sound organization, but it must of necessity change, expand, and remain abreast of the times, and it behooves all of us to be very sure that it does.

Thank you for your kind attention. I sincerely hope that you will all enjoy the program that has been prepared for you.

1333 Grand Ave.

MALFUNCTION OF THE TONGUE

Part I. The Abnormal Swallowing Habit: Its Cause, Effects, and Results in Relation to Orthodontic Treatment and Speech Therapy

Walter J. Straub, D.D.S., M.S., F.I.C.D., San Mateo, Calif.

INTRODUCTION

THIS report on abnormal swallowing habits will be divided into several parts, the first of which will take up the etiology of the abnormal swallowing habit.

The tongue is principally a muscular organ which normally has a great variety of possible movements. The fingers of the most efficient pianist cannot move as fast as the human tongue during conversation. Another property of the tongue is that only the lower part is fixed to bone, while the anterior part of the back, the blade, and the tip are free. All other striated muscles of the body are fixed at both ends. This double fixation ensures exactness of degree of contraction and provides double signals of the momentary position of the muscles to the central nervous system, since tension on both points of fixation is reported. As the anterior part of the tongue is not fixed, it is impossible for the central nervous system to get as many messages from this organ. This is the reason the tongue possesses a less accurate sense of position than other muscular organs.

The sensation of position is assisted by the sense of touch. For instance, if the tip of the tongue touches the incisors, consciousness of the tongue position is keener and more accurate. This factor changes the fundamental diminution of the sensation of place and position. The examiner can ascertain the state of mobility of the tongue if the patient is asked to protrude the tongue between the teeth, through the lips, and out of the mouth cavity, to move the tip gradually

Presented at the biennial meeting of the Pacific Coast Society of Orthodontists, Santa Barbara, California, Feb. 24, 1958; read before the Northern Section of the Pacific Coast Society of Orthodontists, Seattle, Washington, June 3, 1958; the Southern Section of the Pacific Coast Society of Orthodontists, Los Angeles, California, June 5, 1958; the Thirty-fourth Congress of the European Orthodontic Society, Copenhagen, Denmark, July, 1958; the San Mateo County Dental Society, San Mateo, California, Feb. 3, 1959; the Phoenix-Tucson Orthodontists Society, Phoenix, Arizona, Feb. 8, 1959; the Phoenix Central Section of the Dental Society, Phoenix, Arizona, Feb. 9, 1959; the Illi-Wash Study Club of Los Angeles, Beverly Hills, California, Aug. 19, 1959; the University of California, School of Dentistry, Postgraduate Education, San Francisco, California, Oct. 3, 1959 (as an all-day course); the University of California Alumni Association, Jan. 24, 1960; and the Mid-Peninsula Dental Society, Jan. 21, 1959. This paper has also been presented before the Sacramento Dental Society, Sacramento, California, Feb. 8, 1960; the Pacific Coast Society of Orthodontists, Palo Alto, California, Feb. 23, 1960; the Washington, D. C., Dental Study Club, Washington, D. C., Bethesda Naval Hospital, March 12, 1960; the Northeastern Society of Orthodontists, New York, New York, March 13, 1960; the Pedodontists Society of California, Carmel, California, April 4, 1960; the California State Dental Association, San Francisco, California, April 26, 1960; the California Speech and Hearing Association, Southern Section, and Orange County Society of Crippled Children and Adults, Inc., Newport Beach, California, May 21, 1960.

to the ridges of the upper and lower incisors, to the right and left corners of the mouth, respectively, and to the upper and lower molars, and finally to turn it backward permitting it to press on the soft palate.

Abnormal swallowing does not develop during orthodontic treatment, as many orthodontists have been prone to believe. It is not something that develops as the child grows older and has an orthodontic problem. Nor is it the result of thumb-sucking. These are some of the things that I have heard proposed as possible causes of abnormal swallowing. Many have thought that if a child was an abnormal swallower he was also a thumb-sucker. This is not true. Many children who swallow abnormally also suck their thumbs, but rarely, if ever, does one find a case in which the abnormal swallowing is due to thumb-sucking.

In an effort to determine the cause of perverted swallowing habits, I have kept a careful record of the abnormal swallowers seen in my office since 1943 (Table I).

TABLE I. PATIENTS WITH ABNORMAL SWALLOWING HABIT, 1943-1957

		MALE	FEMALE	BOTTLE-FED	BREAST-FED	BREAST FEEDING AND SUPPLEMENTAL FEEDING FOR TWO TO SIX WEEKS
Total number of patients	478	205	273	443	2	33
Age range: 2 to 40 years						
Under 14 years of age	399					
Over 14 years of age	66					
Over 21 years of age	13					
Abnormal swallowers with no contributing habits	223	97	126			14
Abnormal swallowers with thumb- and finger-sucking	171	76	95			10
Abnormal swallowers with other habits	84	32	52			9

It is interesting that only two of the 478 patients were breast-fed. Investigation revealed that the mothers of these two patients had a tremendous supply of milk and that merely touching the breast caused the milk to flow or ooze. In all our experience, we have had five patients who were breast-fed as babies and, with one exception, the history was much the same. In each case the mother had milk that flowed as soon as the breast was touched, and in order to keep from drowning the infant learned to swallow with the tongue forward, between the gum pads, in exactly the same manner as babies improperly fed from a bottle.

Only thirty-three babies were breast-fed in conjunction with supplemental bottle feeding of orange juice, milk, etc., and these were breast-fed for only two to six weeks. Of the 233 patients who had no other habits, fourteen were partially breast-fed for a short time. A total of 171 abnormal swallowers also sucked their thumbs, and eighty-four had other habits in addition to the abnormal swallowing habit.

It was found that in the normal act of deglutition the muscles of expression are never used. Any observed change in these muscles just prior to or during the act usually indicates a deviation from normal in the swallowing habit.

However, the muscles of mastication are used in bringing the teeth and jaws tightly together and holding them during the entire act of deglutition, a process that normally involves the use of some twenty muscles. Figs. 1 and 2

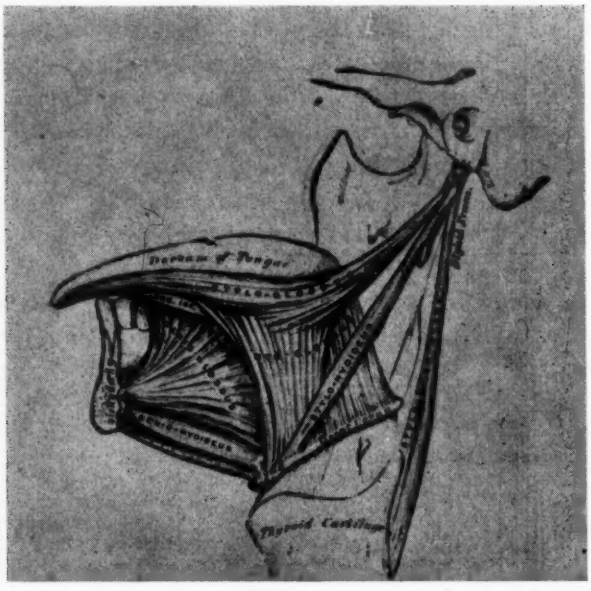


Fig. 1.—Extrinsic muscles of the tongue, left side. (From *Gray's Anatomy*, 27th edition, Lea & Febiger.)

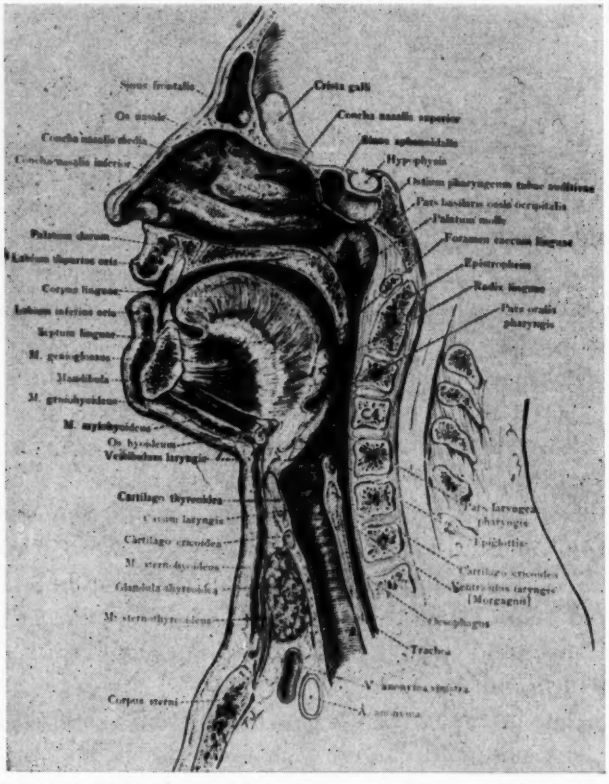


Fig. 2.—Muscles used in deglutition. (From *Gray's Anatomy*, 27th edition, Lea & Febiger.)

show the attachment of the muscles of the back of the tongue to the high hyoid bone and the styloid process.

The only time that the teeth are brought tightly together is during the act of deglutition. At all other times the teeth are apart and at rest. When we masticate our food, our teeth do not come into contact.

Let us now consider some of the different abnormal swallowing habits and the effects that they may have.

In persons who swallow abnormally there is a typical facial grimace, in which a line runs down from the wing of the nose to the orbicularis oris and the lips are protruded (Fig. 3).

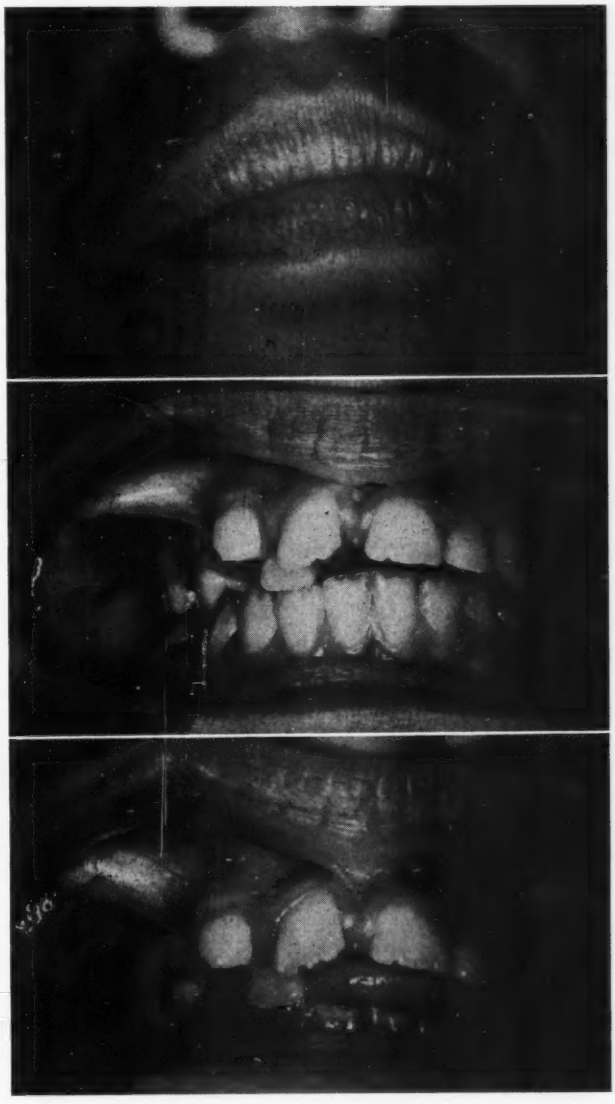


Fig. 3.

Fig. 4.

Fig. 5.

Fig. 3.—The typical facial grimace seen in persons with abnormal swallowing habits.
Fig. 4.—Spaces created between the teeth by the positioning of the tongue.
Fig. 5.—Abnormal swallowing pattern in which the tongue is placed between the teeth in a forward position.

Figs. 4 and 5 show some of the results of abnormal positioning of the tongue during perverted swallowing. The spaces that exist between the teeth in Fig. 4 were caused by a positioning of the tongue which separated the teeth. Holding the tongue between the teeth in a forward position, as in Fig. 5, prevents normal deglutition.

Figs. 6 and 7 show a case in which the tongue is not only pushed up against the upper teeth but is also folded over the lower incisors. When the patient

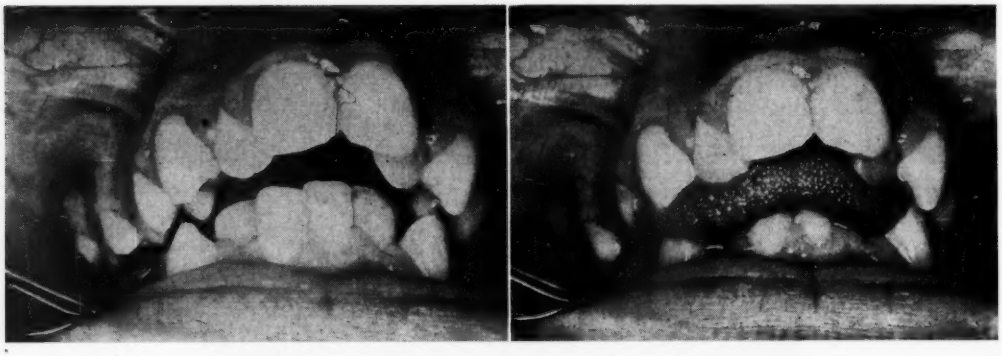


Fig. 6. Fig. 7.

Figs. 6 and 7.—Abnormal swallowing pattern in which the tongue is pushed up against the upper teeth and folded over the lower incisors.

Fig. 8.

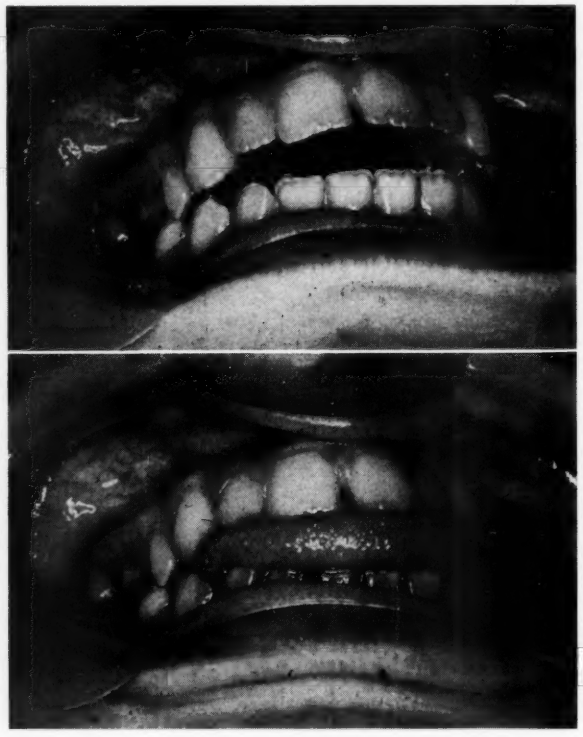


Fig. 9.

Figs. 8 and 9.—Severe open-bite in which the posterior teeth are closed tightly. Note typical diastema between the upper central incisors.

finishes the swallowing act, he retracts the lower anterior teeth and pushes the upper teeth outward with his tongue.

The severe open-bite case shown in Figs. 8 and 9 did not receive orthodontic treatment. The posterior teeth were closed tightly, and there was a typical diastema between the upper central incisors. This case could have been treated orthodontically in a very short time, but relapse would have followed removal of the bands, since the patient's swallowing pattern was such that the tongue demanded the space between the teeth. The tongue was between the teeth and was being thrust between the anterior teeth twice a minute while the child was awake and once a minute while he slept. It is easy to see why the teeth would be pushed apart and why the diastema would develop between the incisors. This case corrected itself at the completion of habit therapy, and the anterior teeth came together when the tongue habit was corrected.

Fig. 10. Fig. 11.

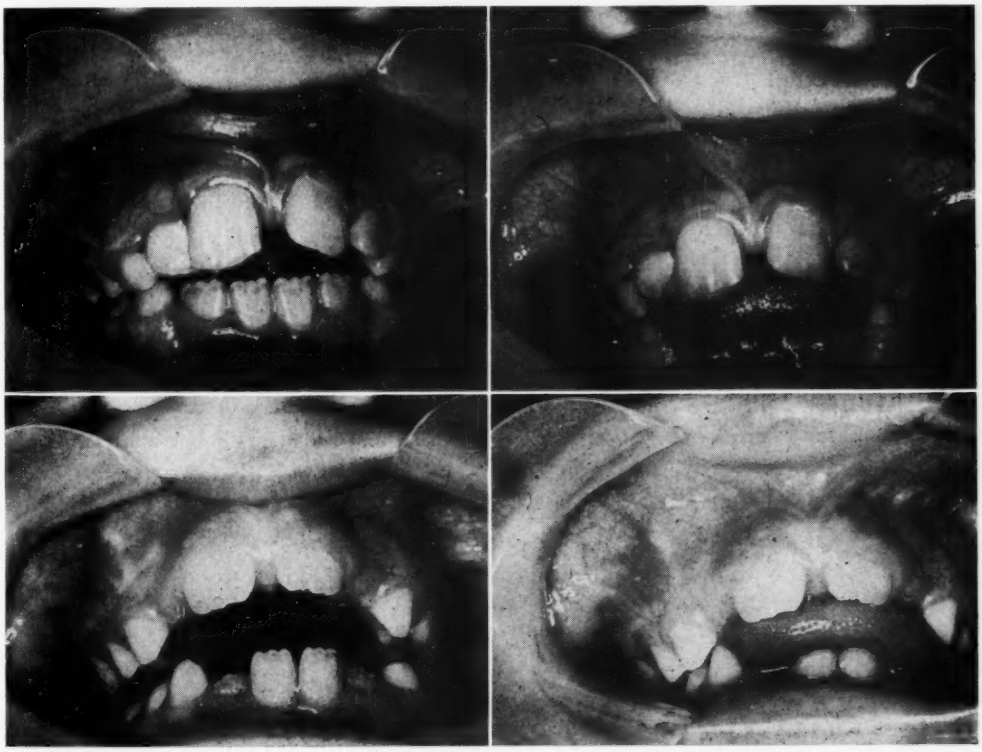


Fig. 12 Fig. 13.

Figs. 10 to 13.—Open-bite cases in which severe diastemas have been caused by tongue-thrusting.

Other open-bite cases in which tongue-thrusting has created severe diastemas are shown in Figs. 10 to 13. It will be noted that these children have different tongue positionings. There is an open-bite, the teeth are closed, and the tongue is between the anterior teeth with the posterior teeth closed.

Figs. 14 and 15 show a case in which the tongue is pushing the teeth forward, one incisor is partially through the process, and the gingiva is receding.

This is the beginning of the gingival recession seen in many cases of tongue-thrusting.

The habit does not improve with age. Figs. 16 and 17 show the mouth of a 42-year-old man who lisps and practically sprays saliva when he talks.

Fig. 14.

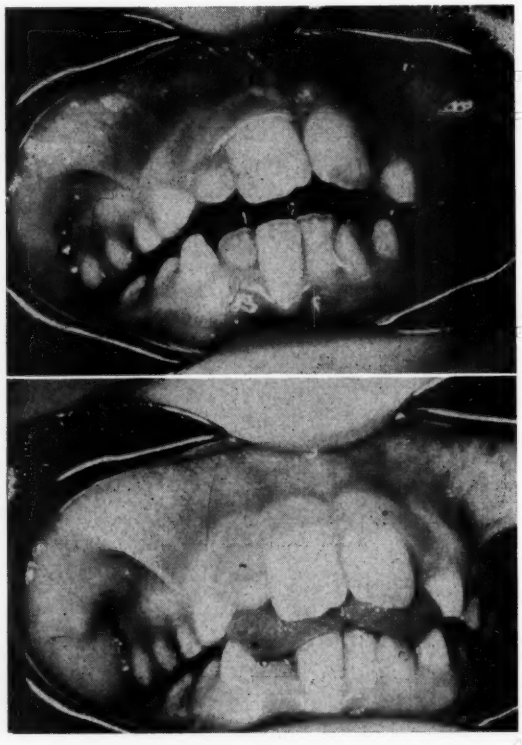


Fig. 15.

Figs. 14 and 15.—The beginning of the gingival recession seen in many cases as a result of tongue-thrusting.

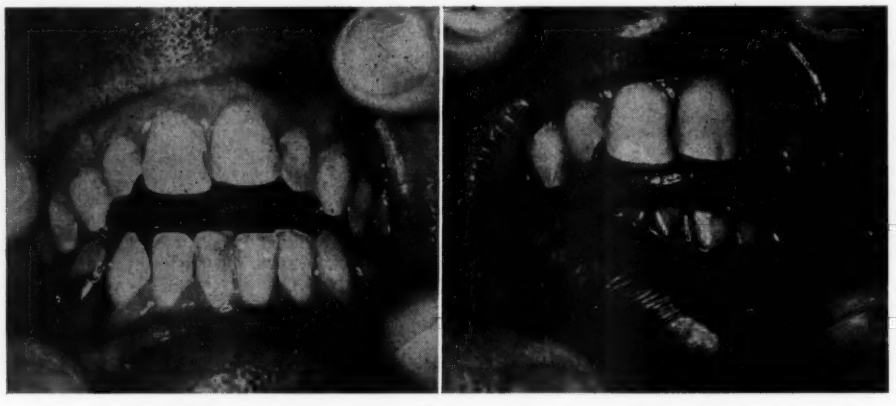


Fig. 16. Fig. 17.

Figs. 16 and 17.—Complete anterior open-bite in a 42-year-old man with abnormal swallowing habit.

His tongue is between his teeth at all times during speech and also during swallowing; this has produced a complete anterior open-bite. The tongue is

forward a good ½ inch when he speaks and when he swallows. The man is a ready gagger and a very difficult patient, from a dental standpoint. This has been a source of embarrassment to him all his life and has given him an inferiority complex.

The close-bite cases shown in Figs. 18 and 19 have fooled the orthodontists who believed that a child who had a close-bite would not put his tongue between his teeth and would not be an abnormal swallower. Actually, these children can be our worst abnormal swallowers, for they not only open their mouths to place their tongues between the teeth but will open as much as an inch in order to swallow abnormally. The photographs show the positioning of the tongue and the extent to which the child opens his mouth to accommodate the tongue.

Fig. 18.

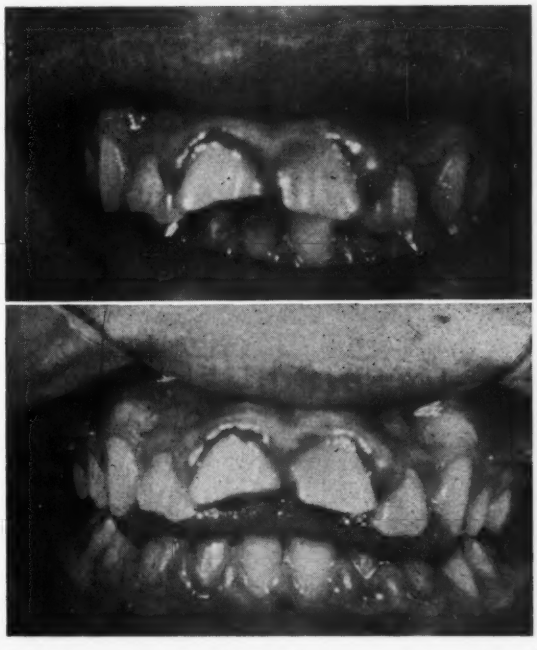


Fig. 19.

Figs. 18 and 19.—Close-bite resulting from swallowing habit in which the mouth is opened to accommodate the tongue, which is placed between the teeth.

In the close-bite case shown in Figs. 20 and 21, the lower incisors almost touch the palate. The child opens his mouth, thrusts his tongue forward, and puts it between his teeth.

Figs. 22 and 23 show another close-bite case in which there is a diastema. These photographs show how the patient slides his tongue over his anterior teeth.

In the severe close-bite case shown in Figs. 24 to 27, the lower anterior teeth touch the palate. Fig. 26 shows the facial grimace made in gathering the saliva, which is the first step in abnormal swallowing. The lips are pushed forward with no line on the first grimace from the wing of the nose to the corner of the mouth. Fig. 27 shows the same face at the completion of the

Fig. 20. Fig. 21.

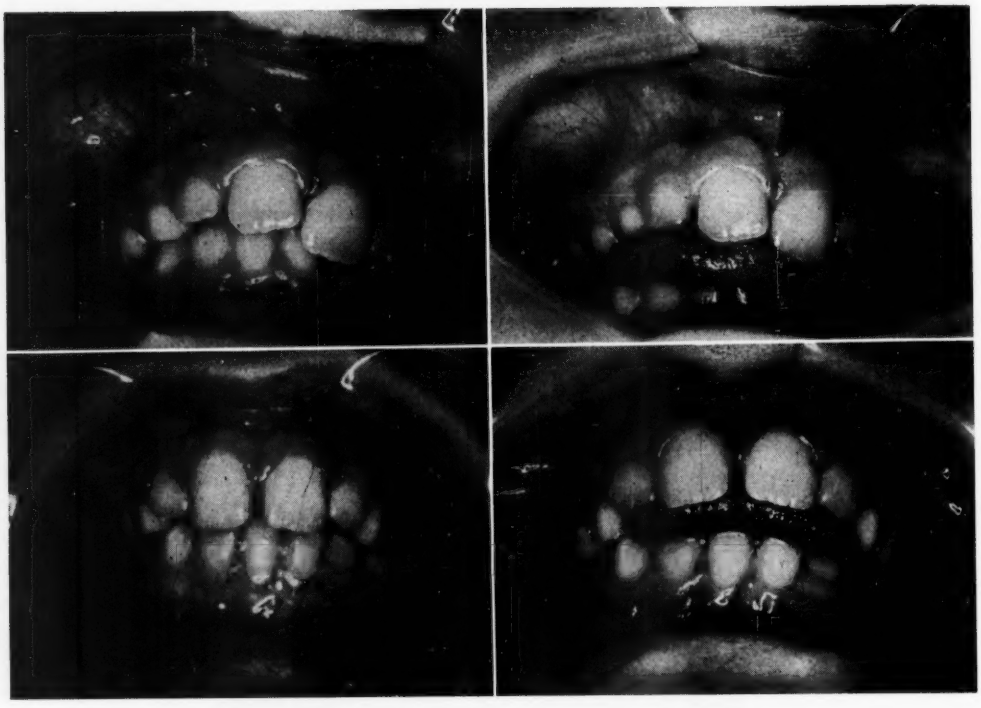


Fig. 22. Fig. 23.

Figs. 20 and 21.—Close-bite case in which the lower incisors almost touch the palate.
Figs. 22 and 23.—Close-bite with a diastema.

Fig. 24. Fig. 25.

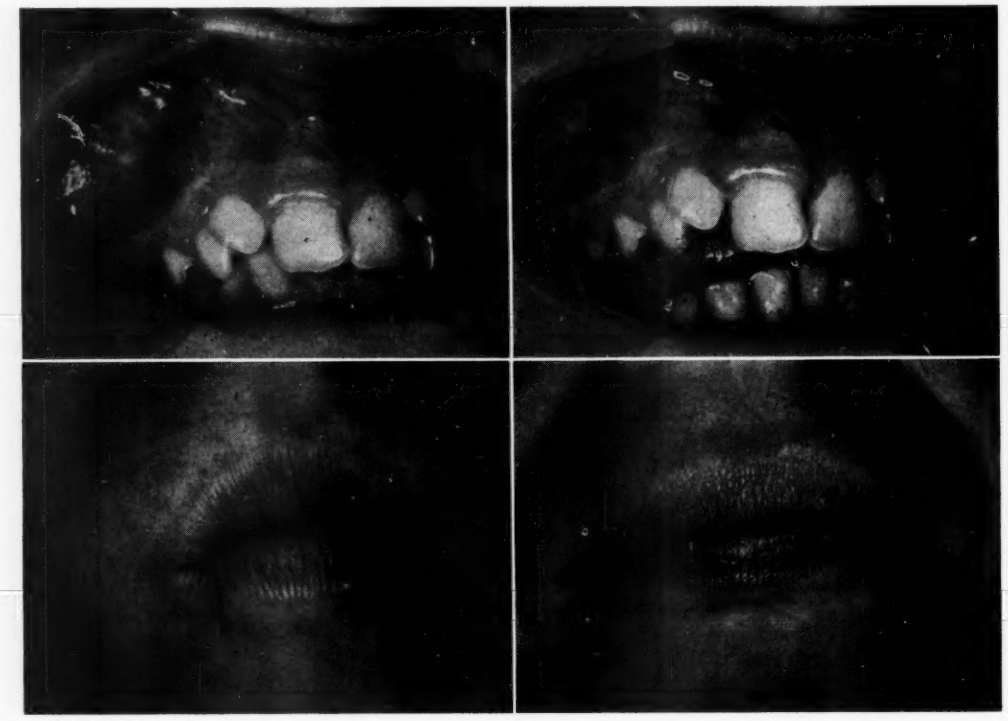


Fig. 26. Fig. 27.

Figs. 24 to 27.—A case of severe close-bite in which the lower anterior teeth touch the palate. Note how much the child separates his teeth to place the tongue abnormally.

swallowing act. Here lines come down from the wing of the nose to the lips, the orbicularis oris is in a protruding position, and the tongue is in between the teeth. The child separates his teeth in order to place the tongue abnormally.

Some cases show a complete collapse of all the upper teeth, including the posterior teeth, and sometimes there is open-bite from the first or second molars

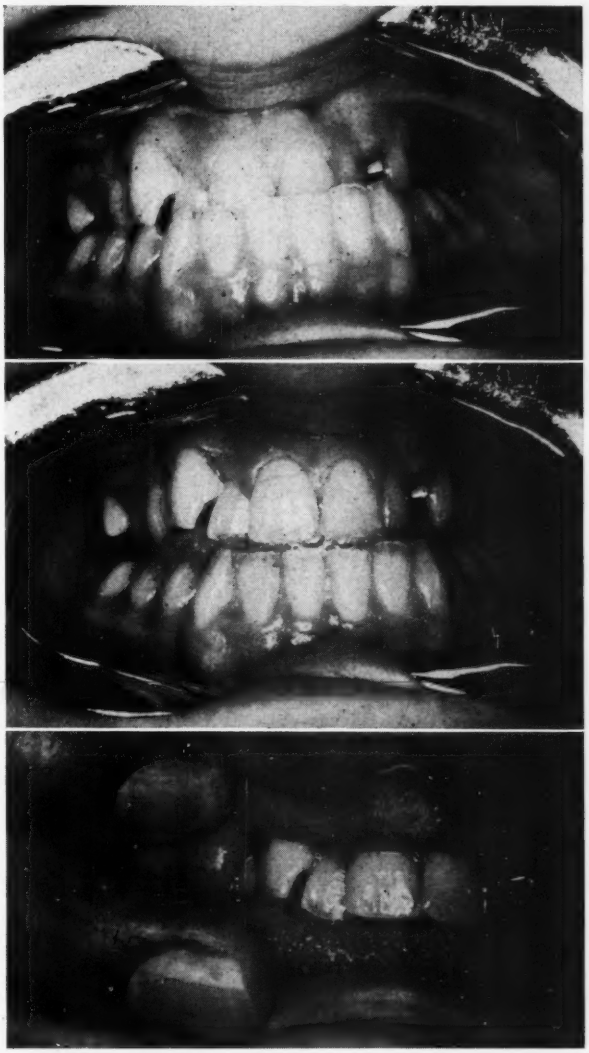


Fig. 28.

Fig. 29.

Fig. 30.

Figs. 28 to 30.—A case typical of those in which abnormal swallowing results in complete collapse of all the upper teeth, including the posterior ones, and sometimes an open-bite from the first or second molars forward.

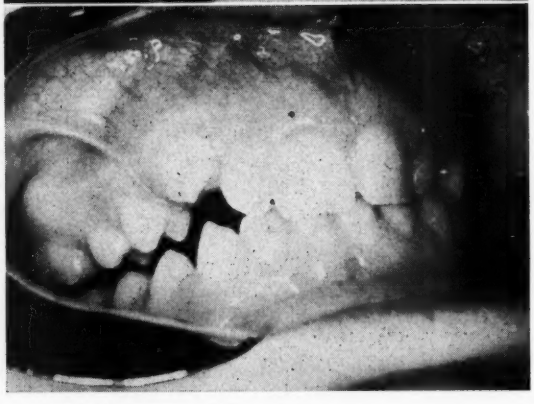
forward (Figs. 28 to 30). The girl whose mouth is shown in the accompanying photographs puts her tongue completely on the occlusal surface of all the lower teeth and never against the palate. Fig. 29 shows the tongue approaching its position for abnormal swallowing.

Figs. 31 to 33 demonstrate another type of swallowing. This child has a side-thrusting habit, in which the tongue is between the posterior teeth in the premolar and molar region (including the cuspid). Fig. 33 shows the position of the teeth when the jaws are closed tightly. The posterior teeth

Fig. 31.

Fig. 32.

Fig. 33.



Figs. 31 to 33.—The results of side-thrusting, in which the tongue is between the posterior teeth in the premolar and molar region (including the cuspid).

do not come together. This condition is seen in many orthodontic cases in which, after the malocclusion has been corrected, side-thrusting causes the posterior teeth to open up until they are out of occlusion. Such cases can be treated successfully only by means of habit therapy to correct the abnormal swallowing pattern.

Abnormal swallowing habits may develop in bottle-fed babies who are given nursing bottles with the wrong kind of nipple. One villain responsible for many of the abnormal swallowing habits seen today is the long nipple that has several holes (Fig. 34). An infant's mouth is very small, and this long nipple, which fits halfway down his throat, will not let him put his tongue against the roof of his mouth, even if he wants to. He cannot suck and swallow properly for, as he sucks, the milk comes so freely that he will either regurgitate and choke or spill the milk out at the sides of his mouth. In self-defense, the child puts his tongue forward and grasps the nipple between the gum pads and tongue and swallows with his tongue in this position. Children who swallow this way from birth may go through life swallowing abnormally.

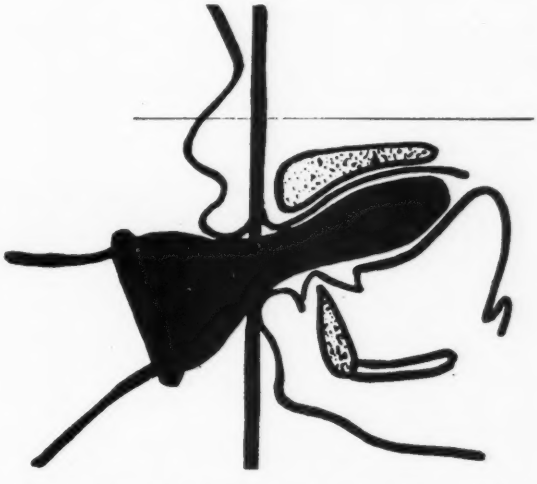


Fig. 34.—Diagram of a type of long nipple that has caused many children to develop abnormal swallowing habits.

This abnormal swallowing habit may be prevented by the use of a very short nipple, such as the one shown in Fig. 35. Since this nipple has only one small hole, the infant must suck for his milk. Also, his lips and face will press against a rubber padding which simulates the breast (Fig. 36). Fig. 37 shows an infant pressing and sucking in the nursing act. It has been found that with this type of nipple the child receives the same amount of milk as he would from the breast. Since children who nurse with these nipples receive less air, they seldom have an excess of milk, seldom regurgitate, have less colic, and seldom burp. A new bottle recently placed on the market has a valve in the bottom of the bottle, which helps to eliminate air colic and allows the milk to flow steadily without creating a vacuum. Thus, the infant gets a uniform amount of milk while sucking a nipple that has only one hole. This bottle is called the "No-Vac Nurser."

Abnormal swallowing does not eliminate itself as the child grows older. There are many variations of the habit, and it may go unsuspected all through life, since many patients who swallow abnormally never develop an open-bite.

It is strange that very little appears in the literature regarding a habit that occurs with such frequency and causes such severe malocclusions. In 1937 Truesdell and Truesdell[1] advanced several theories on the cause of the abnormal swallowing habit, but nothing has been published statistically to substantiate any theories as to the cause of abnormal swallowing.

Fig. 35.

Fig. 36.

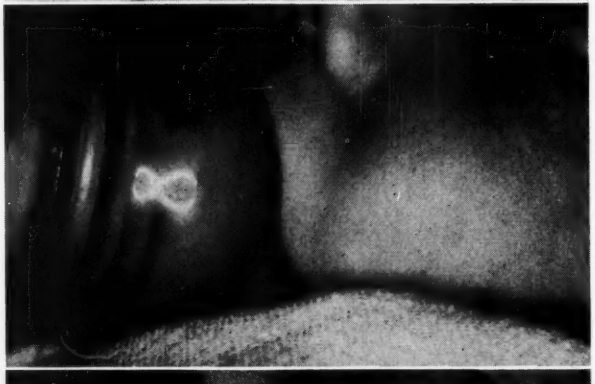


Fig. 37.

Figs. 35 to 37.—A short nipple that may prevent the development of abnormal swallowing habits.

The literature is quite comprehensive, however, regarding the act of deglutition. The word *deglutition* is derived from the Latin words *deglutitio* and *deglutire* (''to swallow down'') and is defined as the act of swallowing.

Deglutition may occur during the ingestion of food, either solid or liquid, or at periodic intervals throughout the day. In order to understand the deviations from the normal, we should have a thorough knowledge of the act of deglutition. The descriptions that follow are generally accepted.

Persons whose teeth are in good or nearly normal occlusion close their teeth firmly in centric relation as the first step. Next the tip of the tongue is depressed and the tongue is placed in the palate, well back in the mouth, with the tip placed at the posterior part of the rugae. The tongue pressure is exerted backward and upward, the tip of the tongue in position and moving slightly distally. Naffziger and associates[2] state: "The soft palate closes off the nasopharynx, the larynx rises and the opening is covered by the epiglottis as the material passes into the upper portion of the esophagus."

Deglutition may conveniently be divided into three steps. In the first stage, which is both voluntary and conscious, the food is gathered into a bolus and carried into the isthmus of the fauces. During the second stage, which is involuntary but still conscious and may be considered a reflex mechanism, the bolus or saliva is carried through the oral and laryngeal portions of the pharynx. During the third stage, which is both involuntary and unconscious, the bolus or saliva is carried through the esophagus into the stomach.

The Truesdells gave a very good description of the act of deglutition: The muscles of mastication bring the jaws tightly together and hold them there during the entire process. Thus, the tongue is supplied with firm boxing against which it can press and gain mechanical advantage in forcing the bolus distally. The tongue raises the saliva or bolus of food, and in its proper position it has a complete boxing around it so that it obtains mechanical advantage with which to force the bolus, liquids, or saliva in the proper direction. From here the musculature used in swallowing is well described by the Truesdells and will not be repeated.

The four openings to be closed in the act of deglutition are the *nasopharynx,* the *two internal auditory tubes,* and the *glottis.* This also forms an additional aid in normal swallowing with a sucking action which, in addition to the pressure of the tongue, forces the liquids distally, although some persons swallow with or without the sucking pressure.

By the closure of the four openings and the sucking pressure, liquids can be swallowed upward (as sometimes demonstrated by contortionists in circuses and side shows) without the liquid running out the nose or escaping its distal pressure. Cannon,[4] in describing human swallowing of a solid bolus, says that when food is sufficiently masticated it is gathered in a depression on the dorsum of the tongue. The tip and lateral aspects of the tongue press against the hard palate and teeth to prevent escape of the food particles forward and laterally to the mouth and cheeks.

Respiration is reflexly suspended. The tongue is pressed upward and backward by contractions of the mylohyoid and hyoglossus muscles, respectively. The tongue, thus acting as a piston, drives the bolus first against the downward wall, the sloping soft palate, and then on between this pharyngeal wall and

the posterior surface of the upright epiglottis, the tip of which lies in contact with the base of the tongue. During this phase the action of the palatopharyngeus muscles has thrown the pharynx into a narrow cleft, and the soft palate is pulled against this opening by contraction of the levator palatini, thus blocking entrance of the bolus into the nasal chambers.

Thus far the esophageal opening has remained closed, mainly by pressure of the larynx against it. With the rise of the hyoid and larynx, the esophagus opens. The epiglottis is pressed back until it shuts the laryngeal aperture. Then, presumably, the tip of the epiglottis slips downward along the posterior pharyngeal wall, pushing the bolus probably with a final impulse into the gullet. Whether or not the action of the epiglottis is a factor in pushing the bolus is a point that was disputed as far back as 1892.[5]

Mosher,[6] in 1927, published studies from which he concluded that the epiglottis acts as a cover for the larynx during swallowing. Barclay[7] stated that "time of swallowing is less than half a second with solids and probably less than one-fourth second with thin watery food." In swallowing we feel that the nasal cavity is suddenly automatically cut off, and we note the change of pressure in the eustachian tubes. The nasopharynx is completely emptied of air for a fraction of a second before we swallow, creating a suction that helps to slide the food down the esophagus after the tongue has thrown it into the pharynx and the upper part of the esophagus. "The act of swallowing must usually be accompanied by negative pressure." "In my own case, swallowing dry but masticated bread, it amounted to 18 cm. of water. The high negative pressure only lasted for about $\frac{1}{8}$ of a second, but even so it was sufficient to carry the bolus from the back of the tongue to the level of the clavicle."

Best and Taylor[8] stated: "As a result of the muscular movement, chiefly on the mylohyoids, a pressure of 20 cm. of water is developed in the posterior part of the mouth pharynx and upper part of the esophagus. A negative pressure. however, exists in the anterior part of the mouth. A negative pressure also normally exists in the closed mouth at other times which aids in holding the lower jaw in the elevated position. When the food is in the esophagus a negative pressure amounting to 35 cm. H_2O or more is created in the pharynx and esophagus, thus aiding in the descent of the bolus."

At the University of Illinois, six miniature strain gauges were placed on the palate in such a position as to record the activity of the tongue anteroposteriorly and at different levels from the midline laterally. For demonstration purpose, water was sucked up through a straw from a glass and swallowed. In this one experiment, pressures of the tongue during sucking were shown to be on the lateral borders against the lingual side of the maxillary teeth, with pressures decreasing toward the midline of the tongue. No pressure was exerted in suction by the tip against the palate. In the act of swallowing the formation of a seal, beginning posteriorly on the lateral borders of the palate was seen. When that pressure reached maximum, there was a sharp rise of pressure anteriorly in the formation of the seal by the tip of the tongue,

thereby enclosing the water between the tongue and the palate and leaving only a posterior opening. The time taken to form the seal was about two-tenths of a second.

After the formation of the seal, the entire tongue was pushed up by its extrinsic muscles acting instantaneously throughout the surface of the tongue. The time that elapsed from the beginning of elevation of the tongue to complete clearance of water from the oral cavity was about one-tenth of a second. Pressures decreased throughout the surface of the palate while water was kept in the oral pharynx. After about one and one-half tenths of a second, clearance of the pharynx was indicated through an elevation of the tongue and bracing against the palate; the pressure was relatively uniform throughout the surface of the palate. After clearance of the pharynx, the tongue retreated from the surface of the palate simultaneously throughout its surface.

In swallowing solid foods, after the seal was formed, the entire tongue was pushed upward to eject the food into the pharynx. The clearance of the pharynx was again a smooth process of bracing the tongue against the palate, and pressures again dropped immediately upon clearance of the pharynx.

The survey continued with the placement of the strain gauges on the buccal surface of the maxillary teeth and maxilla. For example, one strain gauge was placed on the labial surface of the central incisor in relation to the orbicularis oris while another strain gauge was placed superior to the cuspid just anterior to the quadratis labii superioris. The experiment, which involved grasping a straw, sucking, and swallowing water, demonstrated the instrument's ability to sense and record the activity of the lips in reaching for and tensing around the straw while sucking. Pressures were recorded throughout the labial and buccal surfaces in this activity, but (at least, in this single case) no pressure was demonstrated during swallowing.

In speech the records accumulated in this one survey case were in agreement with the general studies of speech. For example, the entire border of the tongue was in contact during pronunciation of the sounds "T" and "D," whereas only the buccal segments of the border of the tongue were in contact during pronunciation of the sounds "S" and "Z." One strain gauge was placed in the midline of the soft palate. This demonstrated that the contact of the tongue with the soft palate was made only in pronunciation of the sounds "K" and "G" and all allied exercises.

MATERIAL AND PROCEDURE

In discussing the abnormal swallowing habit in relation to one of her children, a mother expounded the theory that her own child's abnormal swallowing was the result of bottle feeding. Her reasons and descriptions sounded so plausible that we who had been gathering material on interference or pressure habits decided to survey and keep a record of all patients with the abnormal swallowing habit who came into the office.

From June, 1943, to January, 1957, 478 patients presented themselves with the abnormal swallowing habit. A careful case history was taken on every patient who came for orthodontic diagnosis. The general health, diseases to

date, and recurrent attacks of such conditions as colds and allergy were noted. Then the oral, orthodontic, or interference habits of the patient were recorded. In most of these cases it was not necessary to ask the patient to swallow, as either the position of the teeth indicated the positioning of the tongue or the patient would swallow involuntarily during the examination and reveal the presence of the abnormality.

In many cases, there were one or more habits in addition to the abnormal swallowing. For example, an abnormal swallowing habit would be accompanied by thumb-sucking or by any of the other habits with which orthodontists are familiar, such as leaning, lip-biting, tongue-thrusting, fingernail-biting, sleeping habits, and pencil-biting. The parents of children with abnormal swallowing habits were interrogated as to type of infant feeding, the length of time the child was on a liquid diet, the correlation between infected tonsils, respiratory infections, allergies, and duration of colds, and the correlation between endocrine disturbance and psychiatric problems.

THE ABNORMAL ACT OF SWALLOWING

It was pointed out earlier that in the normal act of deglutition the facial muscles of expression are not used, and any observed changes in these muscles just prior to or during the act usually indicates an abnormal swallowing habit. As stated, the masseter muscles or muscles of mastication are used in bringing the teeth and jaws tightly together and holding them during the entire process. In the abnormal swallowing habit, however, the muscles of mastication are not used in bringing the jaws tightly together. First, the tongue is thrust forward between the teeth, and then the muscles of mastication bring the jaws together until the upper and lower teeth contact the tongue. In most cases only the tip of the tongue is involved, with an open-bite in only the incisor and cuspid region. In others, the sides as well as the tip of the tongue are placed between the teeth, opening the premolars and molars as well as the anterior teeth. The orbicularis oris and other facial muscles of expression, especially the mentalis, enter the act by tensing as if to help the bolus back with the tongue. In many cases the patient blows air forward and builds up a positive pressure in the anterior part instead of a negative pressure. A wave of contraction starts with the facial muscles, the tongue being held between the teeth, with a contraction of the muscles of the throat, such as the palatoglossis, palatostyloglossis, and the mylohyoid.

In addition to the contraction of these muscles, the patient in some cases also has a tendency to move his head forward during the first stage of deglutition as if to help roll the bolus or saliva backward. The act of deglutition takes place approximately twice a minute during the waking hours and approximately once a minute or less, depending upon each individual's flow of saliva, during sleeping hours. Normal swallowing temporarily closes off the nasopharynx, the eustachian tubes, and the larynx from the pharynx while the bolus of food is passing it. As previously described, this causes a partial vacuum which helps to drain part of the nasopharynx and part of the eustachian tube and also relaxes the muscles after the act.

In abnormal swallowing the reverse occurs. The patient does not cause a complete vacuum but has a tendency to blow the remaining air against such openings as the lips, eustachian tubes, and nasopharynx. In the abnormal swallowing habit, the contraction is so intense that patients have a strained musculature about the face and throat (and in some older patients changes in facial expression and contour are seen), whereas the normal act of deglutition is a very relaxing episode.

RESULTS

Of the 478 patients with the abnormal swallowing habit, all but two had been bottle-fed babies. Thirty-three patients were breast-fed and given supplemental bottle feedings for a period of two to six weeks, after which they were left solely on the bottle. In a great many of these patients the anterior segments of both arches had been affected. Either there was a severe so-called "open-bite" to a protrusion of the upper anterior teeth or the anterior segments of both arches were in a protruded position with spaces between the incisors and cuspids. Many of the patients, in addition, sucked their thumbs and had an extreme protrusion of the upper anterior teeth; there was little room to accommodate the tongue in its proper position in the palate, and instead it was found resting on the lower teeth. In fact, in many of these cases the palate was so narrow and ill-formed that even if the patient wanted to put his tongue against the roof of his mouth he could not do so; the tongue was too wide to fit flat against the narrow palate.

As a result of the abnormal swallowing habit, we usually find a narrow upper arch and, in a great many cases, a severely contracted maxilla with upper teeth protruding in an open-bite relationship. The importance of the proper position of the tongue against the palate, with its boxing of teeth in the act of deglutition, cannot be overstressed, as this provides the balance of forces needed to maintain proper arch width in the maxilla. In the abnormal swallowing habit the opposite takes place, and the result is very difficult to correct.

The abnormal swallowing habit has been found to be definitely due to improper bottle feeding. In order to appreciate why bottle feeding can cause the abnormal swallowing habit, one should understand the differences in the mechanics of bottle feeding and breast feeding.

The breast-fed baby, in addition to sucking at the breast, presses against the breast with his nose, cheek, and lips. The teat is between his lips and gum pads, so that there is a combination of pressure against the breast, a squeeze, and a suck on the teat. The tongue is free in the mouth to place itself properly to take care of the normal act of deglutition, since the milk does not run freely but must be sucked out with pressure. When a mouthful is obtained, the source of supply is shut off and the baby uses the normal tongue action as described in the act of deglutition to throw the milk into the back of the pharynx.

In bottle feeding the nipple is very long and, because of the infant's small palate, the nipple reaches partially into the throat or soft tissue area.

Usually the parent wants to be sure that the child gets sufficient milk, or the entire formula, with no effort. To facilitate this procedure, several large holes are usually placed in the nipple. No pressure is used in sucking at the bottle and in order to keep from choking on excess milk the child thrusts his tongue forward with the tip between the gum pads. The nipple is allowed to rest between the tip of the tongue and the upper gum pads and lip since, with the large nipple, the palate is covered. The milk literally flows down the child's throat through the trough of the tongue. When the child attempts to suck vigorously, the milk comes so fast that he chokes before he can swallow properly, or the parent has to remove the bottle from the child's mouth until the excess is swallowed or flows out at the corners of his mouth.

The psychiatric problem of the baby nursing at the bottle should also be taken into consideration. Levy[10] states: "Previous observation and clinical studies have demonstrated that the primary cause of thumb and finger sucking is insufficient sucking at the breast or bottle. In youngsters who suck after bottle feeding the nipple was replaced with one having one small hole increasing the sucking time to 25 minutes, which exhausts the sucking urge and the finger did not go to the mouth after feeding."

In addition to causing the abnormal swallowing habit, improper bottle feeding may help to produce finger- or thumb-sucking habits. When the child is fed from the bottle, the mother should hold him so that he gets a feeling of love and affection and senses the warmth and soft feeling of her body, and he should be made to suck and work for his food. The cold scientific way of feeding, in which the baby is placed in his crib and given a bottle that is supported in a chrome-plated holder or resting on a pillow, soon teaches the baby to shove his tongue forward, maintain the tip in that position, and swallow the back portion of the milk abnormally while the tip of the tongue is receiving a new supply of milk. The love, care, and affection shown by the mother in nursing the newborn child at the breast should be copied as much as possible in bottle feeding. Some mothers, whose children differ considerably in age, have had an opportunity to follow both the old and the new feeding methods. Their older children were fed every four hours from a bottle that was supported by a mechanical holder or a pillow. The younger children, on the other hand, were cuddled and fondled and were given a bottle (which had the proper nipple and hole) when they cried for it instead of according to a rigid schedule. It has been found that when the latter method is followed the mother is much happier and the child is better adjusted, with a better nervous system and a greater feeling of security and well-being. Time will tell whether or not the abnormal swallowing habit can be prevented by this newer method of bottle feeding.

COMMENT

Ways of detecting the perverted swallowing habit are described in the literature. Many methods are used in the correction of this habit. However, the orthodontist who is not familiar with the abnormal swallowing habit may

overlook it in making his diagnosis. Then, when treatment is nearing completion, he will imagine that the patient has developed an abnormal swallowing habit in response to the new position of the teeth and will instigate treatment to close up the anterior teeth when, in reality, the habit had always been present but, perhaps because of the existence of other habits (such as the leaning habit), had not produced an open-bite.

CONCLUSIONS

1. The abnormal swallowing habit seems to be the direct result of improper bottle feeding.

2. The so-called open-bite is not always an indication of the abnormal swallowing habit, as other habits (such as leaning) may affect the denture in such a way that the swallowing habit is disguised. The latter may, as a result, be present in a typical Class II, Division 1 malocclusion with quite an overbite and overjet.

3. The abnormal swallowing habit may be present in tongue-thrusters who have pushed both upper and lower anterior teeth labially, creating spaces and in some cases an edge-to-edge bite.

4. The abnormal swallowing habit may separate not only the anterior teeth but also most of the posterior teeth, including the premolars and in rare instances the first molars bilaterally.

5. In many cases of abnormal swallowing the palate is so high and narrow that, even if he wishes to, the child cannot place the tongue in its correct position until proper corrections have been made.

6. Abnormal swallowing may be present along with other interference habits, such as thumb- or finger-sucking, lip-biting, tongue-thrusting, nail-biting, and leaning.

7. The fact that abnormal swallowing seems to be more prevalent in females than in males should be discounted, since parents may be more concerned with slight irregularities in the teeth of their daughters than with those in the teeth of their sons.

8. Abnormal swallowing and tongue-thrusting may be aided by an unusually large tongue which causes severe open-bite.

9. The abnormal swallowing habit usually produces an open-bite. If not corrected, the habit will cause the anterior segments to relapse to their former position after the completion of orthodontic treatment.

10. It was found that the tongue habit plays an important part in interference with the normal growth of the dentition and is capable of causing many serious malocclusions.

11. The abnormal swallowing habit should be detected and corrected early to facilitate normal development of the palate and the dentitions. When detected early, it should be corrected by habit control or by lessons designed to teach the child to use the proper muscles of deglutition and to place the tongue in its proper position. It is a difficult habit to correct in older patients. There is some danger that patients who have swallowed incorrectly for fourteen

to sixteen years may return to the old habit of abnormal swallowing after all orthodontic appliances have been removed unless they are checked from time to time during treatment and referred back to the therapist until the abnormal habit is corrected.

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No. 2, El Cerrito.

OPEN VERTICAL OSTEOTOMIES OF THE RAMI FOR CORRECTION OF MANDIBULAR DEFORMITIES

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IN THIS article, some of the orthodontic aspects of a new surgical procedure for the repositioning of the mandible will be presented. Since 1848, when Hullihen performed the first operation for surgical correction of mandibular prognathism, many methods have been advocated. The very number of procedures shows that there are inherent difficulties in all of them. Since 1954[1, 2] I have had experience with ninety-two surgical corrections of mandibular prognathism and four surgical corrections of mandibular micrognathism. The open vertical osteotomy of the rami is presented as one method of correcting both of these deformities. Most severe deformities require the utmost in cooperation between the surgeon and the orthodontist if the desired result is to be achieved. The surgical correction by means of the vertical osteotomy in the rami should be reserved for those cases in which there is no discrepancy in the size of the arches. It is often found, however, that even though there is no discrepancy in the sizes of the arches, the teeth need some regulation in the postsurgical position.

METHOD FOR CORRECTING MANDIBULAR PROGNATHISM

Accurate dental models are mounted in an arbitrary postsurgical position by the orthodontist. The surgeon takes this arbitrary mounting of the casts, overcorrects them 1.5 mm. posteriorly, and incorporates a 1 mm. opening between the second molar teeth. An occlusal splint covering all occlusal and incisal edges is then made. On the day before surgery, arch bars are placed on the maxillary and mandibular arches.

Surgery.—An incision, approximately 3 cm. in length, is made about 1 cm. below the angle of the mandible in a skin line. The incision is carried down to the lower border of the ramus, with care being taken not to injure the mandibular branch of the facial nerve. The lateral surface of the ramus is then exposed by elevation of the periosteum. When the mandibular notch has been identified, a vertical osteotomy is made with a nasal saw from the deepest portion of the notch to an arbitrary point approximately 2 cm. above the angle of the mandible on the posterior border of the ramus (Fig. 1). This cut with the saw

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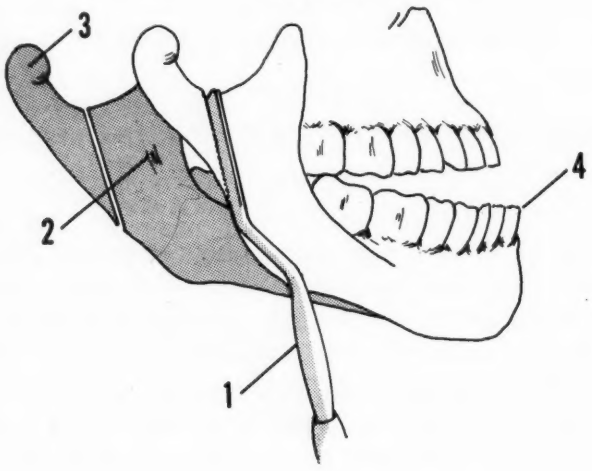
is not carried completely through the ramus, but at the last moment an instrument can be wedged into the cut to effect final separation and thus protect the medial structures. The mandible is then moved posteriorly, with the condylar fragment kept lateral. A similar procedure is carried out on the opposite side.

Fig. 1.



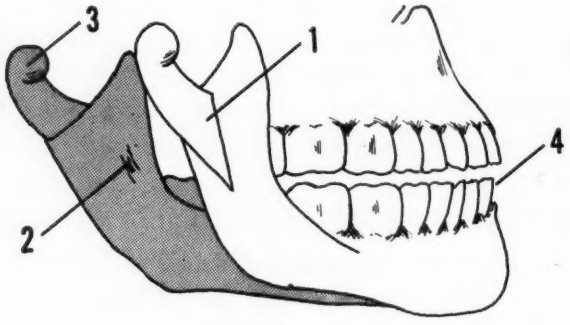


Fig. 2.

Fig. 1.—Drawing of a mandible with prognathism and open-bite. *1*, The saw in position for osteotomy of the ramus; *2*, mandibular foramen; *3*, condyle; *4*, malocclusion of the lower teeth.

Fig. 2.—Drawing of the same mandible after surgery. *1*, The condylar fragment is lateral to the ramus; *2*, mandibular foramen; *3*, condyle; *4*, the malocclusion is corrected.

These wounds are temporarily closed, the previously prepared intraoral overcorrected acrylic splint is placed between the dental arches, and intermaxillary wires are placed. The wounds are then re-entered and inspected for good bone apposition. After the surgeon has ascertained that the condylar fragments are overlapping in a lateral position (Fig. 2), the wounds are closed. The intermaxillary wires are removed seven weeks later, and the patient is then referred back to the orthodontist.

Illustrative Case.—As orthodontic treatment is not the subject of this article, a nonorthodontic case was selected. Also, the case was selected to show a two and one-half year postoperative follow-up.

CASE 1.—Patient A. C., an 18-year-old white schoolboy, was first seen on June 8, 1957, because of masticatory dysfunction due to mandibular prognathism and open-bite deformities. On July 5, 1957, at Santa Monica Hospital, his mandibular prognathism and open-bite were surgically corrected in the manner just described (Figs. 3, 4, 5, and 6). The patient left the hospital on the fourth postoperative day and returned to school in two weeks. The intermaxillary wires were removed seven weeks after the operation. A slight amount of selective spot-grinding was done after the intermaxillary wires and arch bars were removed.

Comment.—Many of the past difficulties associated with the surgical correction of the prognathic mandible can be avoided. The flattened appearance of the chin, the derangement in the structures in the floor of the mouth, and the possibility of delayed union or nonunion of the parts caused by the technique of ostectomy in the body of the mandible are avoided. Also, with the technique of horizontal osteotomy of the rami there is the possibility of an increased

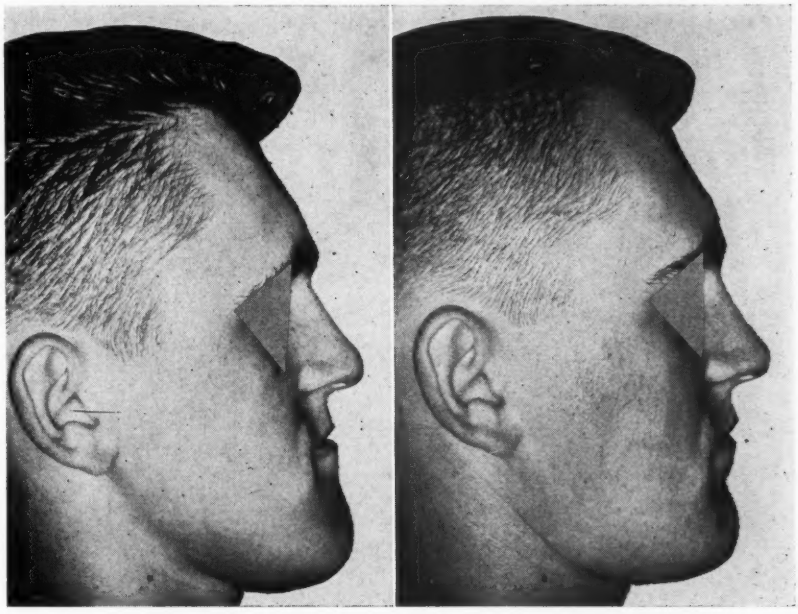


Fig. 3. Fig 4.

Figs. 3 and 4.—Preoperative and postoperative photographs of Patient A. C.

anterior vertical dimension. The possibility of hemorrhage and the tragic sequela of medial displacement of the proximal fragment can be avoided by using the open approach to the vertical subcondylotomy. The postoperative jaw position in these future orthodontic patients should be determined by the orthodontist. He can mount the casts arbitrarily in a postoperative position, regardless of the intercuspation of teeth, taking into consideration only the arch relationship in which he wishes to start his orthodontic treatment. In some cases it may be advisable to complete a portion of the orthodontic treatment before the operation. In other cases the orthodontist may wish to overcorrect the mandibular prognathism in a Class II relationship of the dentition as a future starting point. The reasons for not using an interosseous wire and for

using an occlusal splint have been presented previously.[3, 4] One patient underwent correction twice, at the ages of 18 and 21, because of failure of intervening orthodontic treatment and possible additional growth to the jaw. The second procedure did not differ materially from the first, except that the bone in the osteotomy site was slightly thicker. This girl's second operation was performed on Feb. 6, 1958. Since that time we have not refused any young patient who required a surgical procedure. The youngest patient treated in the past two years was 11 years of age. When these young patients are treated before growth and development of the mandible have stopped, there must be a definite understanding with the parents that a second operation at some later date may be necessary.

Fig. 5.

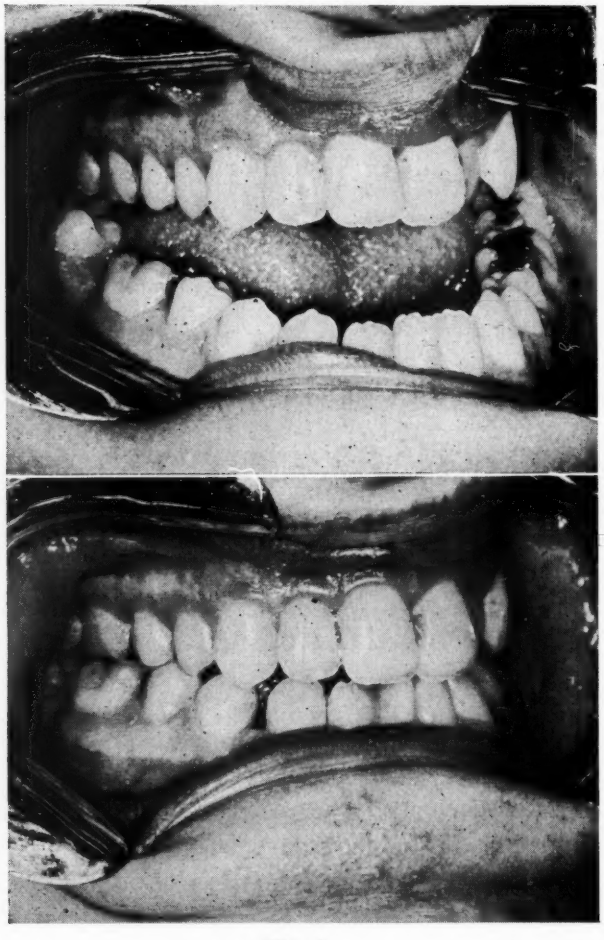


Fig. 6.

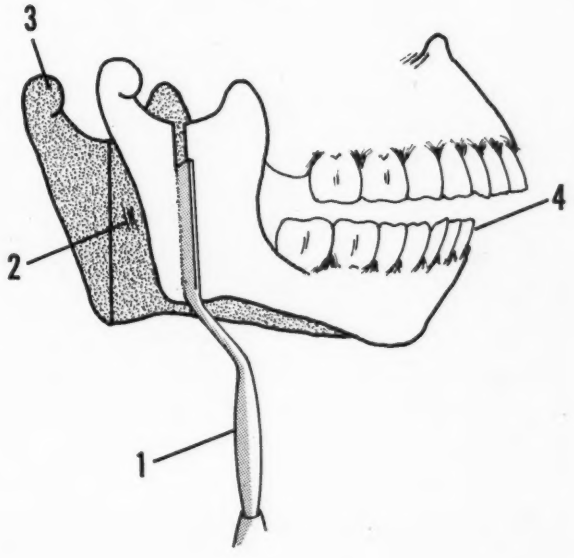
Fig. 5.—The occlusion before surgery. Note 19 mm. deformity.
Fig. 6.—The occlusion following surgery.

METHOD FOR CORRECTING MANDIBULAR MICROGNATHISM

This is similar to the procedure for correction of mandibular prognathism. The exceptions are that the saw cut is made from the deepest portion of the

notch to the angle of the jaw (Fig. 7). When the body of the mandible has been moved forward and intermaxillary wires have fixed it in the preorthodontic position, the long condylar fragment is rotated until it approximates the distal fragment. An interosseous wire is then placed to stabilize the lower end of this

Fig. 7.



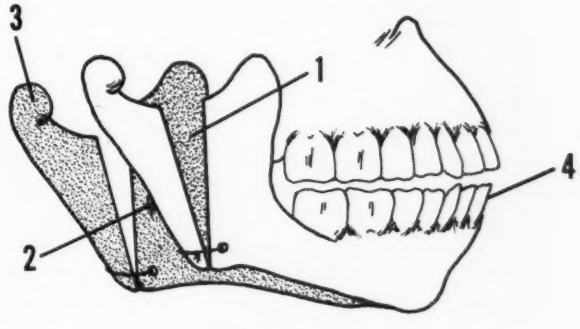


Fig. 8.

Fig. 7.—Drawing of retruded mandible. *1*, Saw in position for vertical osteomy; *2*, mandibular foramen; *3*, condyle; *4*, malocclusion due to micrognathia.

Fig. 8.—Drawing of mandible after surgery. *1*, Defect which fills in with new bone; *2*, mandibular foramen; *3*, condyle; *4*, corrected occlusion.

long condylar fragment (Fig. 8). The postoperative care of the patient is the same as that which follows correction of mandibular prognathism, except that the intermaxillary fixation is allowed to remain for twelve weeks.

CASE 2.—Patient E. L., an 18-year-old white schoolgirl, was first seen at the Orthopedic Hospital in May, 1958, because of masticatory dysfunction due to mandibular micrognathism (Fig. 9). The patient had sustained bilaterally fractured, displaced mandibular condyles in an automobile accident five years previously. She stated that since that time her jaw had been in a retruded position. On June 24, 1958, the girl's micrognathism was corrected in the

Fig. 9. Fig. 10.

Fig. 9.—Preoperative photograph of Patient E. L. Note facial scar from automobile accident.

Fig. 10.—Postoperative photograph of patient.

Fig. 11.

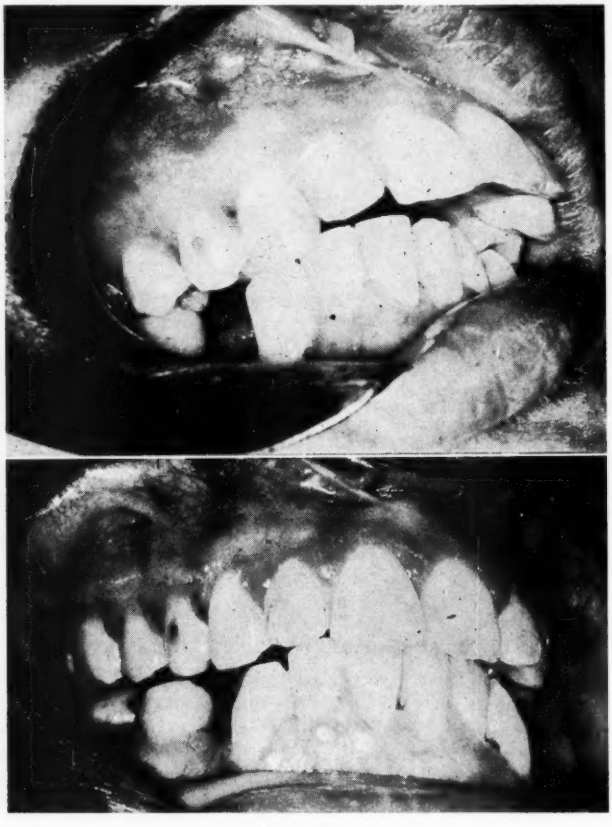


Fig. 12.

Figs. 11 and 12.—Preoperative and postoperative photographs of Patient E. L.'s teeth.

manner just described (Figs. 10, 11, 12, and 13). She left the hospital at the end of one week and returned to school in two and one-half weeks. The intermaxillary wires were removed twelve weeks after the operation.

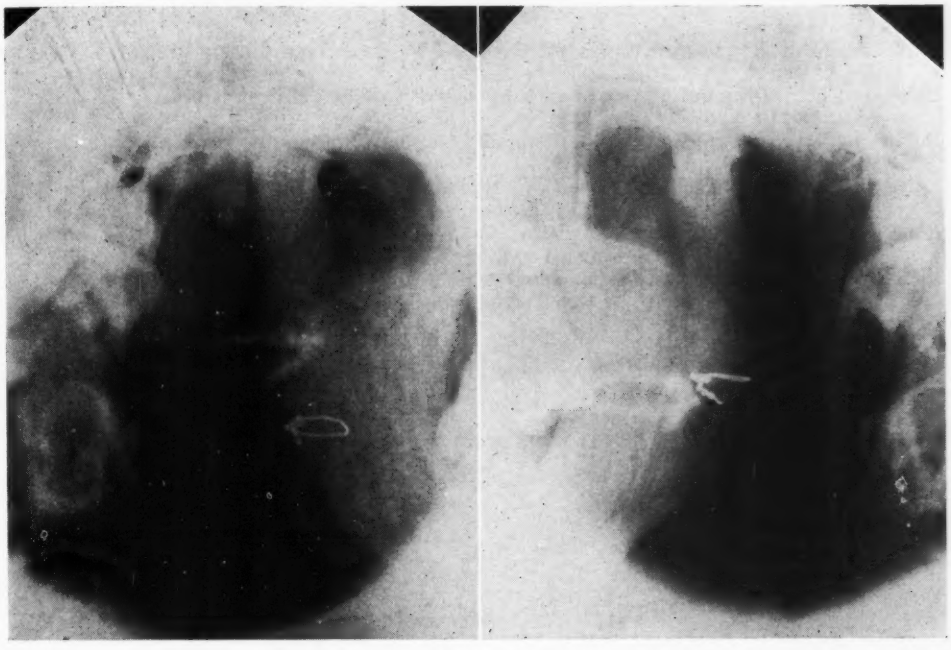


Fig. 13.—Postoperative roentgenograms taken one and one-half years after surgery. Note healing of osteotomy site.

Comment.—This new method of lengthening the mandible is a modification of the procedure originally described in 1954 for prognathism.[1] By this method, it is possible to lengthen the mandible without cutting through important nerves and blood vessels, as when the site is in the body of the mandible. Also, there is no need to sacrifice vital teeth at the site of osteotomy. The powerful muscles of mastication which close the jaws are not separated from the occlusal arches where their stress is borne, as they are when a horizontal sliding osteotomy of the rami is performed. The only muscle pull to be overcome is that of the external pterygoid, and this can be done adequately with a small interosseous wire. In cases previously reported[5, 6] iliac bone graft in the form of either a block graft or bone chips has been utilized to fill the void in the ramus area.

SUMMARY AND CONCLUSIONS

In many cases of mandibular deformity (prognathism, micrognathism, or open-bite) it appears that the surgical-orthodontic team must work together to achieve a satisfactory result. When there is either over- or underdevelopment of the mandible, it appears that the open vertical osteotomy of the rami is the procedure of choice, as it permits the entire basal bone of the mandible to be transferred to a new preorthodontic position. Ninety-two surgical procedures for correction of mandibular prognathism by open vertical osteotomy of the

ascending rami and four procedures for mandibular micrognathism have been performed. All results have been good, and no serious complications have developed.

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HOW LEGISLATION AFFECTS DENTISTRY

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YOU have spent many years in study as well as a great deal of money fitting yourselves to practice your profession. I am sure that you would be most happy if you could be free of governmental and political interference and just practice good dentistry. Unfortunately, in these rapidly changing times, that is becoming increasingly impossible. All professional men, particularly you in the healing arts, must take an active interest in legislative and political matters or the politicians will take you.

Your local, regional, state, and national associations are scientific organizations. They are not established for legislative and economic purposes, so someone else must aid you in this newer and pressing field.

At the risk of seeming provincial, I will attempt to relate what has been done in California, feeling that some of our experiences and activities will be of benefit to professional groups in all states.

Let us turn back the calendar twenty-eight years to 1932, when a series of county clinics (commonly called "health centers") were set up by the Los Angeles County Health Department to aid those who were unable to provide for themselves in that depression period. The idea sounded good, and physicians and dentists (many of whom were not too busy anyway) volunteered their services to man those clinics. Imagine the surprise of these practitioners when, after a short time, they found many of their paying patients, who were well able to finance their own care, turning up at these free clinics! Individual protests were of little avail, so committees were formed in some of the areas served by these health centers. The committees found that they were going to have to take some interest in political matters and develop some political pressure if they were to be successful in changing the conditions.

The groups formed themselves into the Public Health League of California, incorporated under the laws of California as a nonprofit organization. The purposes of the organization were stated as follows:

To protect the public health by the preservation of modern scientific medicine, dentistry and nursing, and to strive by legitimate publicity and effort—

1. To preserve a proper relationship between the patient and his physician, dentist and nurse.

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2. To educate the public to the proper evaluation of medicine, dentistry, nursing and the allied sciences.
3. To make social, economic and legal studies pertaining to the preservation of the public health, and the care and treatment of the sick and injured.
4. To gain the enactment of laws affecting the greater usefulness of ethical medicine, dentistry, nursing and the allied sciences.
5. To protect the public health by opposing objectionable forms of medical, dental and public health legislation.
6. To protect the public against quackery, patent nostrums, fraudulent advertising and the medical practices of unqualified persons and groups.
7. To support public health departments, ethical hospitals, pharmacists, laboratories and other qualified agencies in their efforts to reduce the prevalence of disease and disability.
8. To protect qualified persons, institutions and agencies engaged in the care and treatment of the sick against unjust encroachment upon their functions and activities.

Reports of the early meetings show much activity by the group, which attracted physicians, dentists, nurses, pharmacists, and hospital executives. (At one of the meetings a mortician took an active part in the program.)

Active membership in the Public Health League was confined to dentists, physicians, and nurses who were eligible for membership in their respective county associations. The membership has since been expanded to include hospital administrators and chiropodists as active members, with dispensing opticians, hospitals, veterinarians, pharmacists, Blue Cross, and Blue Shield as contributing members. Associate memberships are open to laymen interested in the objectives of the League.

At the same time that the Los Angeles County group was swinging into action, physicians and dentists in San Francisco found it necessary to cope with some political problems, and they also formed an organization. In 1933 the two groups amalgamated under the name of the Public Health League of California, with permanent offices in San Francisco and Los Angeles and a full-time office in Sacramento during sessions of the California legislature. For ease of administration, the state is divided into a Northern District and a Southern District, each with its own officers and twenty-one councilors operating under a corporate board of directors. Dentistry, medicine, hospital administration, and chiropody are represented among the officers and councilors. A dentist, Rulon W. Openshaw of Los Angeles, is currently president of the Southern District, and another dentist Warren A. Kitchen of San Francisco, is president-elect of the Northern District.

Perhaps this would be a good time to express appreciation of the cooperation that dentists have given to the League. The men representing your profession in League offices have always responded effectively when called upon.

The Public Health League does not establish legislative policy. That is done by the policy-making bodies of the professions represented in League membership. We assist the legislative committees of those professions in carrying out their programs in any manner that they request in local legislative districts and in the day-to-day work of watching the hundreds of bills

before the legislature. In 1959 there were 5,429 measures to watch throughout the entire session of the state legislature. Of these measures, 526 had to be kept under continuous observation by the Public Health League staff in Sacramento, and 177 specific bills required constant and detailed watching every step of the way through the legislature.

The busy professional men who make up the membership of the League do not have the time, the experience and, shall we say, the inclination to carry on the day-to-day "leg work" needed to watch legislation affecting their profession and their individual professional futures.

You will be interested, I am certain, in some of the practical accomplishments of the organization. Early files of the *Guardian,* official publication of the Public Health League, tell of the activities of dentists. California had been a happy hunting ground for advertising dentists. Newspapers were full of large display advertisements showing pictures of patients, testimonials, glaring teeth, and prices in big black type. Organized dentistry decided to do something about this situation in a very practical manner by trying to elect state legislators who would be sympathetic to an antiadvertising law, such as was then in existence in several states. This required grass-roots political organization in every district of the state. What happened in San Francisco is typical and shows what organization can do.

The *Guardian* of March, 1934, says: "Something unique in professional organizations has been taking place in San Francisco. It is a series of meetings of dentists residing in various Assembly Districts, held in community centers in the districts. Luncheon meetings and downtown business meetings are a common procedure, but to ask professional men to meet in their community groups was a new departure—it has been very successful. Not only have these meetings served to weld together the district organizations of the Public Health League but they have brought a closer acquaintanceship among the men. Many were surprised to learn the number of dentists residing in their communities, and to learn that acquaintances in the business district were voting neighbors."

These groups, like others throughout the state, went on to prepare maps of assembly and precinct districts and to list each dentist residing in these districts. Captains and lieutenants were assigned to contact the dentists of each district.

Candidates for the legislature were interviewed by dental committees, and special stress was placed upon the necessity of protecting the public against wild advertising. Favorable candidates were supported—successfully so in most districts.

Let us consider another example from San Francisco. A candidate for state senator indicated his sincere interest in good public health legislation and the maintaining of high professional standards. The incumbent senator had been a thorn in the side of medicine and dentistry for many years. The League decided to assist in making a change by supporting the friendly candidate—not attacking the incumbent but carrying on a positive campaign in support of his opponent. Dentists and physicians were asked to send letters

to their patients and other friends, urging support for the League—endorsed candidate. Stationery of individual doctors was collected, and the letters were prepared for mailing in a central office. On a selected date almost 100,000 letters went into the mail to voters of San Francisco from their personal dentists and physicians urging support of the candidate. He was elected by the largest vote ever given a candidate for that office in San Francisco, and he publicly gave credit for his victory to the medical-dental campaign.

Similar campaigns were carried on throughout the state, and the pattern has been followed very successfully for the past twenty-six years on ballot measures up for general vote and in legislative district elections.

When the idea of writing letters to patients urging political support of candidates was first suggested, there was naturally some skepticism, but we have yet to hear of any dentist or physician who has received an unfavorable reaction. On the contrary, many have said that the recipients of the letters have called them or written them to express thanks for the information and ask that additional letters be sent to their friends. (One man says it is an excellent way of calling to the attention of patients whom he has not seen for a long time the fact that he is still practicing!)

The election campaigns of 1934 paid off when, in 1935, the California legislature adopted a law cleaning up dental advertising. Again, political drama was played. On the day that the bill came up for vote in the Assembly, the joint legislative committee of the two state dental associations had invited a dentist from each assembly district to come to Sacramento. In those days visitors were permitted on the floor of the assembly, and when the time came to vote on the bill there was a dentist sitting beside each assemblyman—either his personal dentist or one well acquainted with him. The bill passed.

I will not take time to list the many things that have happened in the twenty-eight years that the Public Health League has been in operation. When chiropractors and naturopaths attempted to expand their scope of practice into medicine and dentistry by vote of the people and not by education, a powerful statewide campaign was waged. Millions of pieces of literature were distributed through offices of dentists and physicians; letter-writing campaigns, speakers' bureaus, etc. were set up and aided in the overwhelming defeat of the proposals.

Throughout the years there have been numerous attempts to establish state medicine in California. The big drive for such a program came in 1945, when bills calling for a compulsory health insurance system were sponsored in the state legislature by Governor Earl Warren and by the C.I.O. Compulsory taxation was to be inflicted upon every wage earner, with a state-directed system of medical care and some dental care as a starter. The state would fix the fields of dental and medical service and establish the fees.

Again the dentists and physicians combined their efforts through the Public Health League to defeat this scheme, but it was a long and sometimes bitter fight, with the governor intimating that "powerful lobby interests" had

defeated his plan. In 1947 and in 1949 the governor again called for a state-operated health insurance plan, and again it was defeated. Since that time the idea has been dormant, but the Public Health League has remained ever watchful for a revival of the scheme.

Other legislative battles have been fought with antivivisectionists who have repeatedly tried to cripple animal experimentation. They are tenacious and bitter fighters. Some variation of their legislation appears in almost every legislative session.

Fluoridation has been another hot subject before the California legislature. In the recent 1959 session a bill designed to prohibit the addition of fluorine to public water supplies was introduced. This brought a flood of letters and telegrams—both pro and con—to the legislators. The dental associations organized a strong program of opposition, and when the bill was set for committee hearing the room was filled to overflowing. When the chairman of the committee called for a show of hands from those favoring and opposing the measure, it appeared that the audience was about equally divided. Logic won out over emotion when dentistry, backed by the California Medical Association, the Public Health League, and many lay groups, convinced the committee that the bill should be killed.

I have referred to these perennial legislative battles on controversial issues in order to show how necessary it is for the ethical healing arts professions to be alert at all times in the legislative and political fields.

There are many other legislative matters, such as taxes and insurance, of serious concern to dentists. These affect all of you as individuals, and again busy dentists do not have the time to follow the developments through the legislature. The very license which permits you to practice is granted by the state, and the state, through its elected legislators, can change or modify the conditions surrounding that license at any time. The Dental Practice Act protects the people and is zealously guarded by the ethical licentiates who enjoy its privileges.

Thus, we see that dentists and other professional men must assume the duties of citizenship and take part in governmental matters. This applies on all levels—local, state, and federal. School boards, city councils, and county governments should attract the interest of ethical professional men. An effort should be made to have membership on all legislative bodies. This is perhaps easier at the local level than at the state and federal levels; there is not one dentist in the California legislature. In civic groups, service clubs, etc., there is usually a member known as "Doc." It should be the duty of the ethical professions to make certain that "Doc" is the right kind of doctor.

Here in California we have found great strength in united effort. Several years ago an informal group known as the Allied Health Professions was formed. This group—made up of the legislative committees of the dental associations, the California Medical Association, the California Hospital Association, the California State Nurses Association, the California Pharmaceutical Association, the California Association of Dispensing Opticians, the

California Chiropody Association, and the California Veterinary Medical Association—meets prior to primary and general elections to screen candidates for state offices, particularly the would-be state legislators. Those found to be in favor of good public health legislation and the upholding of high professional standards are endorsed and supported by the individual groups in the manner that experience has shown most effective. Friends of the Allied Health Professions who are seeking re-election are given strong support, for the first rule in politics is to support your friends and to try to see that your enemies are left at home. The endorsed candidates are notified of their endorsement by the Allied Health Professions and, needless to say, this endorsement is usually eagerly sought after. In past elections a large percentage of the endorsed candidates have been elected. Of course, not all of the credit can be claimed by the Allied Health Professions, but the successful candidates have said that this support was a telling factor.

Before the legislature meets, the Allied Health Professions hold another session at which each group outlines any legislation that it proposes to sponsor in the upcoming session. If there are any differences of opinion, they are ironed out at that meeting and not in front of the legislature.

After the bulk of the bills have been introduced, another meeting is held at which each profession presents the proposed legislation that it has found in the hopper and gives its recommendations. Again, any differences of opinion are resolved in this meeting, and the ethical healing professions go before the legislature with a united front. Each profession knows the legislative program and the problems of the other professions, and there is no division of opinion before the legislative bodies.

This plan has been most effective in California. It has built up closer liaison between professions and has marshaled the political strength of the allied health professions.

My references thus far have dealt with state legislative and political problems. In recent years we have found federal legislation to be of increasing concern to dentists and physicians. You are all familiar, I am sure, with the Forand Bill (HR 4700). Hearings on the measure were held last summer, and the House Ways and Means Committee has the subject under advisement. This is election year and there is strong pressure, particularly from labor, for enactment of legislation of the Forand type.

Senator John F. Kennedy of Massachusetts has recently introduced a similar bill in the Senate. The best guess is that action will not be taken until mid-March, but what happens between now and the adjournment of Congress is anybody's guess.

You are aware, of course, that the bill is a proposal to amend the Social Security Act to provide for federal purchase of certain health care services for Social Security beneficiaries—specifically, hospital and nursing home care up to a combined total of 120 days per year and surgical services, including oral surgery. The program would be administered by an agency of the federal government, and the fees would be set by an agency of the federal government.

Dentistry, medicine, hospitals, insurance companies, taxpayer groups, chambers of commerce, farm organizations, and many, many others are opposing the measure. Remember, though, that this is election year, and renewed opposition must be expressed to your Congressmen if this governmental inroad into your practice is to be halted.

At the committee hearings last July Bernard J. Conway, secretary of the American Dental Association Council on Legislation, presented the official action of the House of Delegates of the American Dental Association in opposition to the Forand bill and similar measures, as adopted in November, 1958. Dr. Rudolph H. Friedrich, secretary of the Council on Dental Health of the American Dental Association, presented a strong statement of opposition, pointing out among other things: "There is always the real possibility that once a program of this kind is enacted it will be extended progressively to include comprehensive care for large and larger segments of the population." He stressed the positive program of the dental profession as it relates to the nation's health problems. Observers at the committee hearings classed Dentistry's opposition as very strong and effective.

I hope that, by relating some of the highlights of legislative and political activity affecting dentistry and its allied professions during the past twenty-eight years, I have brought out the necessity for members of these learned professions to take a more active part in government. You are held in respect and esteem in your communities. You can speak with knowledge and authority upon health problems. Your patients and other friends expect you to guide them with your knowledge in your field. The patients and other friends of you who make up the group assembled here today could be a powerful political force in behalf of good public health legislation if they are kept informed by you. Experience has shown that they welcome your guidance.

Won't you please take an active interest, as good citizens, in legislative and political matters? Otherwise, the politicians will take you.

510 S. Spring St.

INADEQUACY OF MANDIBULAR ANCHORAGE—FIVE YEARS LATER

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I WAS requested by your program chairman to prepare a paper based on one that I gave in San Francisco in 1955.[1] It was suggested that the earlier paper "could be used as a basis and brought up to date, as I am sure you have added some new material in the past five years." John Hunter[2] once said to a student, "Don't remind me of what I've written; ask me what I think." In spite of this sage remark, and in the realization that many of you have never heard of the above-mentioned paper, I will repeat my introductory remarks: "For a number of years now, I have felt that many of us, consciously or unconsciously, have been avoiding an issue that is important to the final results of our treatment procedures. I refer to the inadequacy of the mandibular arch in resisting the forward horizontal stress placed upon it by intermaxillary elastics. Specifically, this may result in the forward movement, tipping, and crowding of one or more of the mandibular teeth. These malpositions disturb occlusal relations, are unsightly and unsatisfactory to patients and parents, and are capable of producing pathology in adjacent tissues. This may occur during or after active treatment or may not become apparent until long after retention. In treating certain Class I cases with protrusion of maxillary anterior teeth or with shortened arch length as a result of forward drift of maxillary molars, most of us depend to varying extent upon mandibular anchorage. More particularly, it is used habitually in the many and varied types of Class II, Division 1 and, to a lesser extent, in Division 2 cases. The situations mentioned, and especially crowding in the anterior portion of the arch, may also occur, of course, without orthodontic interference and often may be apparent before treatment is started."

I stated in 1955 that problems of mandibular anchorage, as such, are greatly modified in cases that involve extraction of four premolars. In these cases, crowding of mandibular teeth after treatment could often be eliminated. It follows, therefore, that those who routinely wait until the child reaches the twelve-year molar developmental stage and then (also routinely) extract four premolars should not be too concerned with my problems. I cannot help but feel that this is too simple a solution. Perhaps the following "exposé" will help you to see and to sympathize with my difficulties.

We are all creatures of prejudice, whether or not we know it or admit it or try not to be. We are prejudiced by our associations with family, teachers,

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friends, etc. and, in our case, by our training. Perhaps our earlier prejudices can be changed somewhat by later associations and experiences. I hope that most of your early prejudices have been modified; I am sure that many of mine have been, so I am now using a new and nicer word—"judgment." This leads me to accept the following beliefs which were basic in 1955 and remain basic in my thinking today:

1. I prefer to see and treat many cases in the early transition stage, hoping thereby to circumvent developing abnormal situations before they become complex.

2. I am in favor of simple types of appliances, if they satisfy requirements. Perhaps that is why I favor early treatment, for in such cases we may often use the simpler appliances. (These do not include Class II elastics with a mixed mandibular denture.)

3. I believe that we reduce the requirement for four-premolar-extraction procedures in a considerable number of cases by starting treatment at an earlier age.

4. Some patients will require such extractions, no matter when we see them. In these cases, most of us (unless we are exceptionally gifted) need to use multibanded appliances to close spaces, gain vertical dimension, and parallel roots. In other words, unless very favorable conditions exist, four-premolar-extraction situations call for appliances capable of excellent control of both crown and root movement.

5. I favor serial extraction if it is conservatively and carefully applied. It can be a definite advantage, and it is certainly better than waiting for complexities to develop. It should be undertaken with the utmost circumspection. (Before resorting to serial extraction procedures, one would do well to read not only the works of Dewel and Lloyd on this subject but also Moorrees'[3] book on *The Dentition of the Growing Child*. The latter will be sure to impress one with the fact that he is dealing with an individual, not an average, and that variation in growth is the "order of the day." One examination of a young child will not produce sufficient evidence to predict his occlusion at the age of 18.

6. I accept Jackson's fundamental statement that with each child we are dealing with a unique and different set of problems. These require different approaches to treatment and different types of appliances or, at the very least, different modifications of similar appliances. (In the matter of mechanisms and, in fact, in all areas of orthodontic theory and practice, it might be well to consider what Alexander Pope, a very wise man, said several centuries ago: "Be not the first to lay the old aside, nor yet the last to leave the new untried.")

7. I am definitely "from Missouri" when someone states that he has no mandibular arch anchorage problems.

This is not the place to go into my reasons for these concepts. The literature is replete with multitudinous, multifarious, and sometimes even malodorous reasons pro and con in these matters. You are acquainted with all of them.

In my 1955 article there appeared quotations from several authorities regarding normal and abnormal mandibular crowding. These gentlemen have very kindly added some very valuable material in recent communications. Sicher[4] states:

> All teeth, maxillary and mandibular, move toward the midline (mesial drift) throughout life. Crowding of lower front teeth is a frequent occurrence during the last, declining period of growth after the fifteenth year.

Moore[5] rephrased his former statement on crowding of mandibular incisors as follows:

> The occurrence of crowding of the mandibular incisors in young adults or late teenagers has often been blamed upon the eruption of the mandibular third molars. Another possible explanation could be based upon differential growth of the facial growth sites. If mandibular condylar growth continues after bone growth at the maxillary tuberosity has ceased, a change in the relative anteroposterior position of the maxilla and mandible may occur. The relative forward movement of the mandible will carry with it the mandibular denture, which is still occluding with a maxillary denture that is not being carried forward with growth. The maxillary denture, through muscle tension could conceivably restrain the mandibular anterior teeth as they are being carried forward and produce crowding of the mandibular incisors.

Howes,[6] referring to a recent presentation before the Northeastern Society of Orthodontists added the following statement to his original 1955 remarks:

> I have presented further evidence of the lack of change in width of the mandibular basal arch from the first molars forward, after the age of 5 years. It may be at a much earlier age that lateral growth in this area is completed. If such is the case and if the basal bone, with the attached and surrounding musculature, is inadequate for the size of the teeth, then irregularity of mandibular incisors is bound to be present in the adult dentition if the axial inclinations of those incisors are within normal range.

MacEwan[7] adds:

> I have tried to emphasize that for stability of anchorage, 3 ounces is the *limit* that we should use on each side against the entire undisturbed lower denture and that reasonable tooth-to-tooth contact throughout the arch (no spaces) and a lingual wire that touches each tooth at the gingival aspect are essential. Currently I am using 1¼ to 1¾ ounces on each side with just as effective and rapid tooth movement as with 2½ ounces and with less hazard of letting the lower teeth skid.

Thompson[8] says:

> In regard to my statement that it is continued mandibular growth or disproportionate growth of mandible and maxilla that results in a further reduction of the SNa-SNb difference, I must admit that I am still very much of the same opinion. I believe that the longer (time-wise) growth of the mandible occurs most often in those persons who basically have a good pattern and who have enjoyed good mandibular growth, namely, the straight-faced individuals. I have seen a traumatogenic relation develop between the upper and lower incisors. These teeth may have increased mobility and may even be sensitive. The

tissues may reflect this abnormal function as gingivitis. The teeth may be felt to move, and the double tap is heard. I believe that in many instances a functional crowding of the mandibular incisors may occur and this may happen before actual trauma is present. This crowding may actually be a protection mechanism. I have noted that some of my cases look better and the tissues appear to be under less tension when some crowding takes place. Function appears to be improved.

Anchorage is still a problem, and I believe that it goes beyond appliances. We are dealing with so many variables it is almost impossible to compare cases in order to decide what appliance in procedure may be ideal. Certainly growth and direction of growth are factors in anchorage. Again, we certainly have less of an anchorage problem in excellent pattern cases.

Function, as ever, seems to dominate my thinking and there is a rude awakening awaiting the orthodontist who finally examines his cases from this point of view. It poses a greater challenge than esthetics, and we can be sure that our problems are far deeper than we had suspected.

To his former discussion on the possibility of moving maxillary molars distally, Downs[9] now adds the following comments:

Since 1955, evidence is becoming available that with proper adjustment and cooperation from the patient, maxillary molars may be moved distally bodily. However, the evidence must be carefully checked; it is not easy to determine mesiodistal positions of lateral structures. The question now seems to be a validation of the treatment plan, rather than the possibility of distal movement of molars.

(I suspect that Downs is wondering, in the last sentence, whether distal movement of maxillary molars might cause a "jam" in the second and third molar areas. If so, I agree and would rather not deliberately invite impaction in this area.)

Wylie[10] adds to the remarks of Downs:

We have a substantial number of extraoral anchorage cases carefully evaluated in this department (University of California), where improvement in arch relationship has been obtained and where the only plausible explanation is one of outright distal movement of maxillary teeth, and by that I mean not a relative distal movement but an absolute one.

(Wylie states that D. R. Poulten[11] was responsible for this study.)

It becomes apparent that present-day thinking confirms former suspicions that crowding of mandibular incisors occurs frequently with normal growth and is also associated with different and perhaps abnormal rates of growth. It becomes important, therefore, to avoid increasing this tendency by injudicious use of intermaxillary elastics. It also has become apparent that distal movement of maxillary molars can be accepted as one of our most common procedures. In my 1955 article I enumerated eleven means by which forward shift and crowding of anterior teeth in the mandibular denture could be reduced in cases in which extraction of four premolars was not indicated:

1. Multibanding of all or most of the mandibular teeth.
2. Utilizing the mandibular teeth for anchorage purposes before any movement is attempted or permitted in this area.
3. The use of supplemental anchorage in the form of mandibular tooth- and tissue-borne devices.

4. Limiting the number of maxillary teeth to be moved at one time.

5. Use, in selected cases, of the occlusal guide plane.

6. Extraction of permanent maxillary second molars.

7. Extraction of the two maxillary first premolars.

8. The use of some type of cervical or occipital anchorage instead of or supplementing intermaxillary anchorage.

9. Timing our selective orthodontic procedures.

10. Myofunctional therapy and the control of certain abnormal tongue-thrusting, mouth-breathing, and other habits that obstruct tooth movement.

11. Extraction of one mandibular incisor.

Since these measures were discussed in some detail, and since this material is available in the literature, it now seems necessary to mention only the present deviations or additions which the experience of five years has suggested.

1. *Use of Multibanded Appliances.*—You are aware by now that I lean toward the use of simple appliances. Therefore, I would not deliberately choose multibanding unless I were sure of gaining better mandibular anchorage by this means. In addition to cases involving extraction of four premolars, we use multibanded appliances in cases in which there is an exaggerated curve of Spee, usually noted in mandibular arches. Following Strang,[12] we include second molars in the assembly. (I shudder at the glib use of the term "strap-up." It does not fit in with the often-expressed hope that we are dealing with a procedure that should be as nearly physiologic in character as possible.)

2. *Utilizing the Mandibular Teeth for Anchorage Purposes Before Any Movement is Attempted or Permitted in This Area.*—I am inclined to believe that this procedure is of more importance in preserving anchorage than multibanding of mandibular teeth. Banding all of the teeth produces considerable movement. A passive mandibular lingual arch may well be the best way to prevent much of this preliminary movement. Gaston[13] advocates this type of anchorage and apparently has little fear of displacing mandibular teeth. Wilson,[14] also favors this type of anchorage, although he utilizes it *after* teeth are moved in the lower arch. Both men use a lingual arch that touches as many teeth as possible at the lowest possible point. In 1959 Wein[15] published an article in which he described the results of using Class II elastics with a mandibular lingual arch. According to a cephalometric appraisal, there was apparently little undesirable change in the mandibular anterior teeth. It is interesting to note that Wein, like Gaston, uses a removable lingual arch and gives it a slight tip-back action in the molars. Even with this evidence, I still do not have too much confidence in this type of anchorage unless we (1) have an exceptionally resistant mandibular bone and tooth combination and (2) also utilize one or more of the other means of preventing undesired movement of mandibular teeth. Sensible procedure in treatment planning should seek to take advantage of as many measures for anchorage protection as seem practical.

3. *Supplemental Anchorage.*—I still have not had much success with the use of supplemental anchorage in the form of tooth- and tissue-borne devices. The writings of Bedell and Moyers and Higley were mentioned in 1955. Since then others (notably Lusterman[16] in 1957) have given us new ideas. There seems opportunity for continued experimentation in this area.

4. *Limiting the Number of Maxillary Teeth To Be Moved at One Time.*—There seems to me to be no argument on this point which, of course, embraces the accepted principle of using lighter elastic pressures. Mershon's method is often a satisfactory one to use in moving maxillary molars distally on one side only. For the benefit of those who never knew or have forgotten, his method was to construct a plain 0.040 inch labial arch so that it was passive in the molar buccal tubes. This arch had a stop on each side anterior to the tubes and a hook in the canine region on the side in which distal movement was desired. He then moved his stop back on this "action" side, so that the arch cleared the anterior teeth, and then used very light Class II elastic traction on that side only. Many, many other means of moving only one or a few teeth at a time were mentioned in 1955. Many of them have proved satisfactory if well chosen to suit a particular situation.

5. *The Occlusal Guide Plane as a Method of Preserving Mandibular Anchorage.*—In certain Class II cases with close-bites cephalometric tracings seem to have shown that the use of this appliance results in the distal movement of maxillary teeth. We think that this device is somewhat similar in its action to the monoblocs used in Europe. Perhaps we are getting indirect assistance from muscular pressure. If mandibular anterior teeth are not very stable, the occlusal guide plane may cause some untoward tipping. For this reason, it should always be used with a labial mandibular arch wire. Schleichter[17] has given us some data on what the mechanism accomplishes. He arrived at the following conclusions:

> (1) The posterior border of the mandible invariably returned to approximately its pretreatment position, (2) molar relationships were always changed from a Class II to a Class I occlusion in a short period of time, (3) the head of the condyle tended to return to a location comparable to the pretreatment position in every case, and (4) relative mandibular prognathism was not increased statistically or clinically by this method of treatment.

Clinically, in cases that are successfully treated, we feel that not only upper molars but all of the upper teeth change from a Class II to a Class I relationship. The possibility of lessened stress on mandibular anchorage rests upon the reduced requirement for excessive and prolonged Class II elastic pressure, since with this appliance the mandible is normally positioned in relation to the maxilla, whether elastics are used or not.

Terry[18] has added some pertinent thoughts on the use of this appliance:

> The Oliver guide plane may be manipulated to do several things that are advantageous in treating a Class II, close-bite orthodontic case.
>
> It can "unlock" the occlusion by reducing cuspal interlocking so that the dental units may more easily move.

It can assist the moving of the maxillary buccal segments distally with the mandible remaining nearly in its same position.

It can assist in the moving of the maxillary buccal segments distally while stimulating the mandible toward a forward growth response.

It can retard the forward growth of the maxilla while encouraging the forward growth increment taking place in the lower face.

It can assist in maintaining the maxillary arch in its present position while gaining as much mandibular forward growth and anterior accommodation as may be expected in individual response.

These variations may be accomplished by conscious appliance construction toward the sensible application of anchorage and pressure through proper adjustments and patient cooperation.

The guide plane is an auxiliary attachment to the maxillary lingual arch and is always used in conjunction with efficient labiolingual appliances. It allows full use of other auxiliary attachments.

6. *Extraction of Permanent Maxillary Second Molars.*—We still remove upper second molars to reduce the necessity for excessive force in distal movement of maxillary teeth, perhaps particularly to prevent "jamming" and impaction in this area. Personally, I like to get all factors of a case "on my side" as much as possible. This procedure could certainly be one means of accomplishing this worthy purpose. Recently, some ideas regarding selection of cases for upper second molar extraction have appeared in the literature. Wilson[19] states: "If maxillary second molars are extracted, the anterior bite level can be retained without any bite closure, and in those instances when the maxillary molar is moved distally one actually can expect a degree of bite opening." Graber[20] has written at length on this subject. We are more inclined toward extraction of second molars in cases in which the following conditions exist:

(a) Poor structure or large fillings are found in the upper second molars.
(b) Upper second molars are situated far buccally.
(c) Upper third molars are developing impaction tendencies.
(d) Lower third molars on the same side are developing impaction tendencies or missing.
(Conditions a, b, and partially d, incidentally, indicate a definite lack of bone growth.)
(e) There is a low apical (a and b) base difference, indicating that with this procedure there is a good possibility that maxillary buccal segments can be moved distally enough to obtain a satisfactory occlusion of anterior teeth.
(f) The maxillary third molars appear in the x-ray examination to be of good size and structure and in such position that eruption into the second molar areas can be expected. (This, of course, is an essential requirement.)

7. *Extraction of Two Maxillary Premolars.*—Our ideas on extraction of two maxillary premolars have not changed. In such cases, there is usually an excellent mandibular arch with no extraction problems and no excessive curve of Spee, which we wish to leave "as is." Usually there is a high apical base difference which requires considerable distal movement of the six maxillary anterior

teeth. It may be particularly indicated in cases with an open-bite tendency. In many cases we may use intramaxillary anchorage and tissue-borne and extraoral supplemental anchorage, thus leaving good mandibular arches alone. In 1955 it was stated that leaving the posterior teeth in Class II relationship was satisfactory for function, esthetics, and future health. Since then it has been noted that the upper molars in this relationship tend to depress the lower molars and tip them forward. This may be detrimental to surrounding tissues, and it may reduce mandibular arch length and thus encourage crowding of anterior teeth.

Fig. 1. Fig. 2.

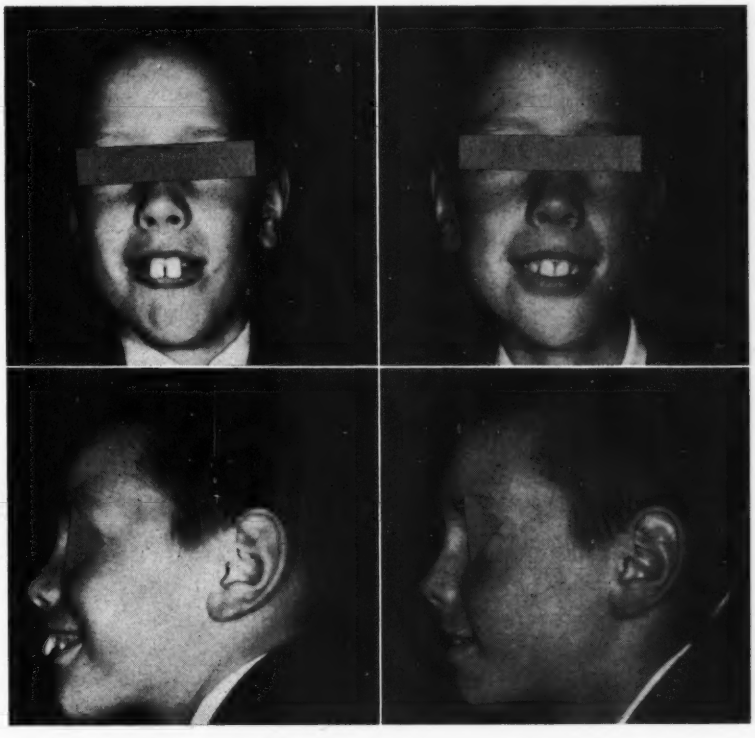

Fig. 3. Fig. 4.

Figs. 1 to 4.—Early treatment of developing Class II case with cervical gear and anterior elastics. (An exaggerated case has been selected for the purpose of convincing skeptics.)

8. *Cervical or Occipital Anchorage.*—Since 1955 orthodontic literature has been replete with material on the subject of extraoral anchorage. Perhaps, however, some brief remarks on personal experiences will not be amiss. After all, extraoral anchorage gives us one of the very best means for the protection of mandibular anchorage. I am now using the Kloehn type of cervical gear. Lately I have incorporated some of Jay's ideas in this field, although I certainly fall short of his extraordinary results. I find that one of the appliance's most satisfying uses is in the developing Class II cases during the transition period. I feel that moving first molars distally has not only permitted but encouraged normal eruption of premolars and canines in these cases. If the maxillary incisors are also in a protrusive position, these can be corrected by means of this

appliance with an anterior elastic. Thus, it is possible to gain normal lip action and normal breathing before these functions reach the point of no return. In the transition dentition I do not like to use the mandibular arch for anchorage purposes, but I also do not like to let things go until we have increased problems.

Fig. 5.

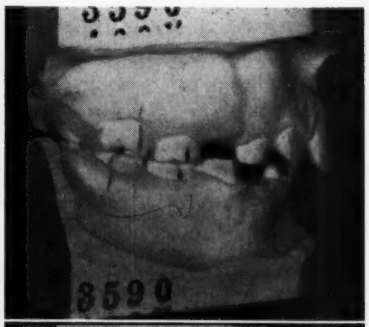

Fig. 6.

Fig. 7.

Figs. 5 to 7.—Distal movement of maxillary molars in the transition dentition showing effect on erupting permanent premolars and canines.

If maxillary anterior teeth are moved distally by this method, one often finds that their crowns have also been tipped lingually. In such cases, edgewise attachments may be used to torque them. This is usually accomplished after distal movement is completed, but one may have anterior bands in place *during* distal movement for better elastic control. I feel insecure in torquing incisors, since this may cause trauma. If tipping is not severe enough to invite future injury to surrounding soft tissue, I may choose to let Nature take its course. It has been stated, however, that Downs' A point may be moved posteriorly

during treatment and that this movement often may be important in the improvement of facial balance. If this is true, torquing may become necessary in some cases. One of the ideas beautifully illustrated by Riedel in his clinic in Detroit was the prolongation of extraoral anchorage treatment for longer than

Fig. 8.

Fig. 9.

Fig. 10.

Fig. 11.

Fig. 12.

Fig. 13.

Figs. 8 to 13.—Satisfactory complete treatment with cervical gear and bite plate appliance only. Fig. 8 shows original cast, Fig. 9 shows final cast, and Figs. 10 and 11 show intraoral views of completed case. The original mandibular denture is shown in Fig. 12 and final mandibular denture in Fig. 13. No appliance was used in the mandibular arch.

(*Note:* Probably cervical gear will be used for retention purposes. It is likely that removal of maxillary second or third molars will be in order.)

is commonly practiced. Some cases extending for two or even three years result in acceptable complete treatment. In recent papers, Moore[21] showed cephalometric tracings of cases in which this type of treatment was used. Results indicate that it is usually possible to change a Class II molar relationship to a Class I relationship. Sometimes the maxillary molar moves distally. Sometimes it remains in the same anteroposterior relationship and moves directly downward with growth. We find also, of course, that sometimes it is tipped back and sometimes it moves back bodily. In the prolonged cases, results are

probably due to this "holding-back" action during normal forward and downward growth of the mandible. If we get the "tipped" molars, it is possible to overtreat and allow molars to right themselves. We usually try to overtreat, in any case, because of the usually persistent forward translation tendency. Also, we wish to leave the maxillary first molar in that ideal forward crown-tipped position which Stoller described as existing in the best occlusions. Cervical gear can be used in cases that require more distal movement on one side than on the other. The arm of the facebow on that side is made longer than on the side requiring less distal movement. This arrangement was suggested by Haack and Weinstein.[22] It works, but I regretfully admit that I do not understand the engineering principles involved.

Many consider that supplemental use of extraoral appliances in conjunction with intermaxillary elastics is most important. There may be an advantage in the area of stimulating mandibular growth in the use of elastics. If so, the daytime use of elastics and the nighttime use of extraoral gear might serve to (1) provide continuous pressure, (2) relieve to some extent the stress on mandibular anchorage, and (3) stimulate mandibular growth. Holdaway[23] notes that in some techniques, *strong* elastic pull should be preceded by prepared mandibular anchorage. Of course, you will note that I, at least for the present, cannot bring myself to go along with either of these procedures. One cannot please everybody.

I should mention that since 1955 Kanter,[24] among others, has also given us ideas on the supplemental use of extraoral anchorage.

This brings us to the use of cervical gear during the retention period, which is almost indispensable when one observes a tendency for the maxillary teeth to start slipping forward toward their original positions. The Hawley retainer will not prevent this forward slipping, since it usually is a movement en masse. It may be that our treatment plan in these cases included too much distal movement. I have noticed that many supposedly corrected cases exhibit the forward maxillary denture translation characteristic *when viewed from the proper angle.* MacEwan[25] emphasized this point. In the cases under discussion (that is, those that require distal movement of maxillary teeth) we have two important criteria for gauging successful stabilization: (1) the maxillary first molars in full distal position with crowns tipped forward and (2) the maxillary canines with crowns also slightly tipped forward but situated in full distal proximity to the mandibular canines with the teeth in occlusion. These must be viewed not from the front but at right angles to the areas in question. In situations of mesial drift after active treatment, perhaps it would have been wiser to eliminate something in the maxillary molar areas—usually second or third molars. This has been done with success before, during, or even *after* active treatment. Combining cervical gear and various types of acrylic retainers is often practical. Lewis[26] has reported some recent developments of this nature. To my mind, those who express concern about lack of cooperation in the use of extraoral anchorage appliances have just not tried them out in a consistent and confident manner. I was amused at some remarks by MacEwan[27] in regard to this matter: "I have been using a lot of cervical gears much like Kloehn

advocates. In fact, using a little skulduggery, I have got the kids in this area to consider them a mark of distinction so that many ask for them when they are not the thing to use." We do the same thing, and threaten our patients with the "full treatment" if they do not cooperate. With the parents' full understanding and with a proper preparatory procedure, we should be able to gain cooperation in about 90 per cent of our cases. In the other 10 per cent most of the patients would not wear intermaxillary elastics either.

Klein[28] and Parker[29] have provided further cervical gear information since 1955.

9. *Timing of Selective Orthodontic Procedures.*—Our original ideas on "timing" our selective procedures to reduce stress in the mandibular arch seem to be reasonable, as far as they go. In the past five years much has been added to our understanding of growth in the areas of most interest to orthodontists. Acquiring and acting upon this understanding in treating our cases may easily prove more important than our understanding and application of various mechanisms. If we can change a Class II situation to a Class I situation during active growth, we have less need to place undue stress upon mandibular anchorage. In other words, this is an example of working with Nature and with growth and development rather than depending upon mechanical devices alone to gain our ends. In practice, this means that, as stated in 1955, "the only possible way to control timing for different procedures is to have the child under observation early." It is sometimes difficult in the usual orthodontic practice to have patients organized so that a given phase of treatment, such as Class II, Division 1 therapy, coincides exactly with pubertal mandibular growth. This is true also in cases in which cervical gear is exerting a holding tendency on the maxillary first molars and we are awaiting an assist from normal mandibular development to resolve our Class II arch relations. If possible, however, timing in relation to growth should help in preserving anchorage.

I know that I could easily "get in over my head" in matters of growth and development, so perhaps we should leave further discussion in this field to our wiser and more scientific brethren. One may, however, try to listen, understand, and apply in practice what the research people say in these matters. Moore,[30] Wylie,[31] and Ricketts[32] have made recent studies on growth. There is no doubt in my mind that most of our spectacular treatment successes are more often due to working (perhaps by chance) with excellent growth than to appliance manipulation.

10. *Myofunctional Therapy and Control of Abnormal Habits.*—There is little to add concerning myofunctional therapy for protecting mandibular anchorage. Early treatment as an aid to establishing normal muscular function and tone has been mentioned. This is important in active procedures but more important during retention. Until recently we have not paid enough attention to tongue habits and other habits which handicap our treatment procedures, including anchorage.

11. *Extraction of One Mandibular Incisor.*—The extraction of one mandibular incisor, usually at or near the end of treatment, to relieve mandibular

crowding remains a doubtful procedure, as it was in 1955. Ballard,[33] in 1956, and Bolton,[34] in 1958, presented some interesting figures on anterior tooth size. Ballard indicated that the width of the six mandibular anterior teeth should be 75 per cent of the combined width of the six maxillary anterior teeth. He stated that in discrepancies most mandibular teeth are too large. This seems to indicate that we might reduce this discrepancy by extraction. Usually I would not like to do this if an original close-bite condition existed. I cannot continue to condemn the practice of stripping mandibular anterior teeth to correct crowding, since so many of my peers have apparently accepted the procedure. This does not appeal to me, however, except in those cases in which only very slight bone and tooth discrepancy appears. In 1955, reference was made to equilibration after active treatment as an aid in preserving the alignment of mandibular anterior teeth. At that time we were particularly interested in grinding anterior teeth in both arches in protrusive relation and canines in occlusion and in lateral excursion with the idea of preventing undue stress on the six mandibular anterior teeth. Several interesting papers on this subject have been written since then. Blume,[35] in 1958, for example, presented a simple and practical way of correcting prematurities in the occlusal position. If we find difficulties other than the above, we feel it best to refer the patient to a periodontist. Much harm can be done by untrained persons or by careless operations in this type of work.

In all of this, we may be comforted by Thompson's feeling that perhaps some crowding of mandibular anterior teeth relieves a traumatic condition. This idea is important in those troublesome "borderline" situations in which we must consider whether to extract and take the patient through an ensuing complicated treatment or not to extract with expectation of a mild residual crowding.

CONCLUSION

As in 1955, I am still trying to emphasize that "the exceedingly variable and often inadequate mandibular arch" should be considered in the correction of Class II and similar conditions. In the last five years we have seen important progress in growth studies and in the relation of growth and development to treatment procedures. The application of this knowledge may be the important area for future orthodontic progress. Cephalometric appraisal has indicated that distal movement of maxillary molars is possible. Pressure exerted by extraoral mechanisms (which eliminates anterior pressure on the mandibular arch) results in various forms of maxillary molar movement. We have some knowledge of what we formerly suspected and thought we saw clinically.

SUMMARY

With some slight changes, I can only repeat my former statements on this subject.

If a case requires mandibular anchorage, the orthodontist should plan deliberately to protect that anchorage in the best way available for that particular case. In this worthy endeavor, the following suggestions are offered:

1. When deciduous teeth are present in the mandibular arch, little or no Class II elastic pressure should be used. In treatment, extraoral anchorage should be considered.

2. In most mandibular anchorage situations, one should plan to use every available precautionary measure to prevent disturbance of resistance units, including extraoral anchorage (at least as a supplementary technique). The various types of mechanics should be considered, and the one which seems most suitable to the case at hand should be chosen. The lingual, labiolingual, edgewise, Johnson, Universal, or Crozat man should not hesitate to step across an imaginary boundary and use the mandibular appliance which common sense dictates is best for the case he is treating. Sectional treatment in the maxillary arch can result in lighter stress on mandibular anchorage, and that stress exists for a shorter time. Directing major tooth movement *through* cancellous bone channels, rather than *against* compact areas, should also reduce stress requirements. One should plan to move only those teeth that must be moved. Normal shift of individual teeth may be expected following the development of space provided by movement of other teeth or following the removal of interference.

3. In selected cases, mandibular anchorage hazards should be reduced by extraction of maxillary second molars or maxillary first premolars.

4. During retention, one should continue to observe tendencies for disturbance in the mandibular arch, whether they are due to treatment or to natural causes. Probably most cases should have equilibration by either the qualified orthodontist, a qualified general dentist, or a periodontist. One should note particularly whether the mesiolingual inclined plane of the maxillary canine is striking the distobuccal inclined plane of the mandibular canine, either in occlusion or in excursions of the mandible. This might cause mesial tipping of mandibular canines and crowding of mandibular incisors. If it is impossible to prevent considerable crowding by any available means, it may be desirable, under the conditions previously mentioned, to extract one lower incisor. Stripping might alleviate slight discrepancies.

5. The various steps in treatment should be timed, if possible, in relation to new growth studies. Since mandibular growth usually picks up at puberty, elastic therapy may be used if necessary, in Class II cases during this stage of growth. It is wise to time for a younger age in girls than in boys, for growth in boys is not only later but more prolonged. As our knowledge of the growth of the denture and the face gradually increases, we probably will pay more attention to circumventing the abnormal and aiding and abetting the normal than to mechanical devices. Indeed, some are already "guiding growth," as it were, with the perhaps more knowledgeable use of the simple appliances of yesteryear, notably such devices as bite plates and cervical gear.

6. I must add a compelling additional thought. In 1955 I quoted the late Charles Waldo's[36] paper, entitled "A Practical Approach to the Problem of Orthodontics." Since then, Wilson[37] has added the paper that he read at the 1959 Golden Anniversary Luncheon of the American Association of Orthodontists in Detroit. Both of these papers should be read and reread. They

stress the real responsibility of orthodontics. What has this to do with mandibular anchorage? Nothing directly, but the ideas expressed in these two papers are intimately connected with anything that we might do or hope to do in orthodontics.

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ANCHORAGE IN ORTHODONTICS

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EVEN a superficial perusal of orthodontic literature reveals that practically everything has been said that can be said concerning the problem of anchorage in orthodontics. Therefore, it will be possible only to reiterate and emphasize some of the discussion of former authors and perhaps, in a few instances, to indicate possible misconceptions or statements that may lead to them. The two most inclusive and comprehensive articles on this subject that have appeared in comparatively recent literature are those by Renfroe[1] and Hopkins.[2]

Anchorage may be defined as the resistance which the dentofacial structures offer to change in form or position under an applied force. It appears preferable to consider anchorage entirely as various degrees of resistance, especially as applied to the teeth, since it is impossible to achieve complete anchorage within the dentures.

In certain orthodontic groups anchorage is a much discussed subject, while in others it is mentioned only infrequently. Tweed[3] probably did much to emphasize its importance when, after deciding that his treatment had been producing too many bimaxillary protrusions, he concluded that the only way to avoid this, if the appliance were confined to the teeth, was to prepare anchorage, particularly in the mandible, prior to the application of Class II elastic force or any force in which the posterior teeth are to be the nonmoving units or the source of greatest resistance. Anchorage is adequate, and from this standpoint it becomes a relatively insignificant consideration when it is derived from an extraoral source.

There is a great deal of variation in the type of appliance that successful orthodontists advocate for adequate anchorage, especially mandibular anchorage. For example, Johnson,[4] Oliver,[5] Gaston,[6] Wein,[7] and many others, employing the plain round labiolingual and Johnson twin-wire techniques, appear satisfied with a well-fitting Mershon or soldered type of lingual arch wire during the application of anteroposterior forces of either the intramaxillary or intermaxillary variety. Wilson[8] and others prefer a carefully adapted and manipulated loop-lingual arch wire, while Jackson[9] considers the plain round labial arch wire with labial auxiliary springs to banded canines the most reliable appliance for adequate mandibular anchorage. Of those who use the mandibular lingual arch

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wire for anchorage, Johnson prefers a soldered, inflexible, nonremovable type, Wilson chooses a comparatively flexible removable wire with loops incorporated, and Gaston favors an inflexible removable type without loops.

The above-mentioned authors say little or nothing about any mandibular anchorage preparation. Wilson[8] does state: "In cases where there is labial axial inclination of the mandibular teeth prior to treatment, it is advisable that these be retracted and verticalized before the loop-lingual arch wire is secured for Class II traction." He says nothing as to how space is obtained to retract and verticalize these mandibular teeth if contacts are tight before treatment is started. Tweed,[3] on the other hand, who employs the full-banded edgewise appliance, believes: "The production of a stable anchorage is most important for successful orthodontic treatment and should be the initial concern of the operator." He particularly emphasizes this with regard to mandibular anchorage preparation prior to the application of Class II elastic force. All mandibular teeth are positioned over basal bone, the incisors being tipped lingually and the posterior teeth distally to resist best the pull of the Class II elastics.

In this anchorage preparation, Tweed actually produces a malocclusion to correct one. This can be considered an example of an expedient of treatment. Such expedients can be valuable assets in treatment, although some orthodontists do not consider preparation of anchorage to this degree necessary or even advisable.[10] In view of the fine treatment results achieved by Tweed, it is difficult to take exception to his methods; nevertheless, he might obtain the same result by mechanical reinforcement of his anchorage rather than by such drastic distal tipping of the teeth.

Two points relative to Tweed's anchorage preparation may merit discussion or clarification. One is the contention of some clinicians that an unmoved tooth gives the best anchorage. The considerable movement and loosening of the teeth that occur during anchorage preparation by Tweed's method are not desirable. Both Tweed and Strang,[11] however, maintain that, as a result of this preparation, the teeth are placed in positions of mechanical advantage for force resistance and that this more than counterbalances the loosening of the teeth and the accompanying loss of bone stability. This is evidently true if judged by the clinical results of these operations. One may logically ask how long teeth remain unmoved after instigation of orthodontic forces. The answer would be, "Usually a very short time."

The second point is the frequent reference to the teeth, in prepared mandibular anchorage, offering mechanical advantage. Teeth cannot offer mechanical advantage; nor can their prepared position be likened completely, as described by Strang,[11] to "that of a tent stake driven into the ground in such a manner as to best resist the pull of the guy ropes which under stress would force the stakes deeper into the ground when the storm comes." Teeth are not inanimate objects; nor is the investing tissue inanimate. Teeth move only as a result of the changes produced in the investing tissue which, in turn, results from cellular response to an applied force. Intrusion and bodily tooth movements, the two most difficult to achieve, are the movements that give the most effective resistance to an applied force. The mandibular teeth are positioned

to resist these two movements at the completion of anchorage preparation, and the maintenance of these positions during the application of Class II elastics is the reason for the so-called dynamic anchorage rather than mechanical resistance of the teeth. The force in the arch wire that produces and maintains the prepared axial inclinations and causes the teeth to resist both intrusion and bodily movement supplies the mechanical advantage, but the teeth move as a result of biologic action.

Strang,[11] in discussing further the mechanical and biologic action that results from mandibular anchorage preparation, points out: "When the premolar teeth are placed in distal axial inclination and the arch wire tied into the brackets, as in Fig. 1, forward tipping of any of these units, that may subsequently take place, will exert a downward pressure on the tooth next in line mesially. Resistance to downward pressure on a tooth is the greatest of all resistance power because functional demands require this to be so." While it is agreed that these anchorage-prepared teeth are positioned to resist intrusion

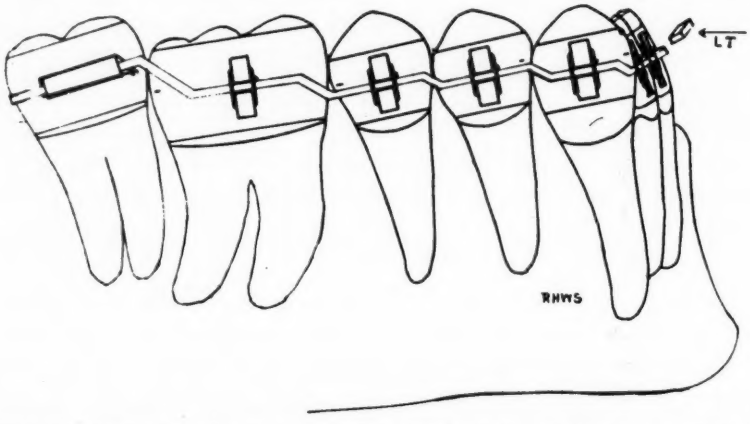

Fig. 1.—Dynamic stationary anchorage or prepared mandibular anchorage. (From Strang and Thompson: Textbook of Orthodontia, ed. 4, Lea & Febiger, 1958, p. 532.)

and bodily movement because of the mechanical action in the arch wire, it is difficult to imagine a forward tipping of any individual tooth during application of Class II elastics. Even if individual tooth movement occurs, it would appear that the tooth would have to slide occlusally as it came forward along the incline of the tip-back bend and therefore could not produce a downward pressure on the tooth next in line mesially. In concluding this part of the discussion, it may be said that the mechanics in the arch wire during anchorage preparation has placed the teeth in a position to resist intrusion and bodily movements, which they do biologically during the wearing of the Class II elastics as the mechanics maintained in the arch wire dictates. Thus, there can be agreement as to what happens, even though there may not be equal agreement concerning the explanation of why or how it happens.

The need for mandibular anchorage may be questioned, since posterior movement may be accomplished by the use of extraoral anchorage. Both Holdaway[12] and Tweed, however, feel that better mandibular change is obtained

in the treatment of Class II patients by tugging on the mandible during the vigorous use of Class II elastics than is accomplished when only extraoral forces are applied for lingual and distal movement of the maxillary teeth. These clinicians and others have demonstrated that the use of Class II elastics tends to carry the mandibular teeth forward of their correct or former relationship to the mandibular basal bone; they found this to be true even when a full-banded appliance was used on the mandibular teeth, unless anchorage was previously prepared. It is their opinion that the use of a lingual arch wire or a labial arch wire without bands would permit even more forward displacement of the lower denture in relation to the basal bone if the same vigorous use of elastics were applied over the same time span.

Much less objective evidence has been offered to demonstrate what happens when the plain round lingual or labial appliance is used for mandibular anchorage. One report by Wein[7] on the lingual arch as a source of anchorage in Class II treatment showed that in twenty-eight of the forty cases he analyzed cephalometrically the incisor mandibular angle before treatment was at or above the 95 degrees indicated by Tweed as being the upper end of his normal range of 85 to 95 degrees. Thirty-two of the forty cases showed an increase in this angle; sixteen had an increase of as much as 3 to 9 degrees. Of the eight cases in which no increase was shown, two did not change, two decreased 1 degree, two decreased 2 degrees, and two decreased 3 degrees. It would be difficult to imagine any decrease as a result of Class II elastic force alone. In at least twenty-eight of these forty cases, Tweed and those who follow his methods undoubtedly would have started treatment by carrying the lower posterior teeth distally in order to upright the incisors; certainly, they would not have wanted to do anything that would permit these incisors to increase their labial inclination. This would mean that Tweed would have prepared anchorage in the mandibular arch before using Class II elastics. No mention of this was made by Wein, so it is assumed that he placed the lingual arch for mandibular anchorage and applied Class II elastics without first carrying posterior teeth distally and uprighting incisors.

Some[12, 13] do not agree that incisors should be uprighted, especially if the forward relationship of the mandible to the maxilla cannot be improved, since doing so might make it necessary to retract the maxillary incisors unduly and this could result in an excessive lingual-axial crown inclination. In other words, as the posterior relationship of the mandible to the maxilla increases, the greater must be the labial inclination of the mandibular incisors to avoid too much lingual inclination of the maxillary incisors as the establishment of an acceptable incisor overjet is attempted.

Much has been said about the amount of force advisable in the movement of teeth, and this is closely allied with the type of resistance offered and the resulting effect on the teeth and supporting structures. It has been said that a ton of force[14] could be used if it were applied over a distance of not more than one-half the thickness of the periodontal membrane. Heavy forces applied over a greater distance crush the membrane and do not permit the cellular

response desired to produce a slow, nonpathologic type of tooth movement. With this excessive force, the tooth seems to resist any effective movement until the damaged periodontal tissues and bone are removed by undermining resorption. The process also may be accompanied by root resorption. This probably has been the main reason for the turn to light round wires, at least in the beginning phases of treatment, even by those orthodontists who employ a full-banded appliance of the edgewise type. Light wires have been advocated for years by Johnson[4] and others.

The comparatively recent Begg[15] technique has received considerable attention. This technique employs an 0.014 inch (or even lighter) arch wire which, through the use of expansion and contraction loops, can deliver a very light force or a comparatively heavy one. Reciprocal anchorage or resistance is employed to quite an extent, partially because in most cases teeth are removed as a part of treatment. This form of anchorage or resistance, of course, usually produces movement of all teeth connected to the arch wire or receiving force indirectly.

One discussion by Begg relative to his technique may deserve comment. He implies that when an optimum force range of 150 to 200 grams is used reciprocally between the incisors and molars, the incisors will move backward with no discernible forward movement of the molars. That no discernible forward movement of the molar units occurs with the application of this 5 to 6 ounces of force seems improbable, since, after removal of first premolars, posterior units will often drift forward seemingly in response only to intrinsic forces. Certainly, therefore, it would be expected that posterior teeth would move forward under 5 to 6 ounces of orthodontic appliance force.

Begg also states that if the force in the appliance is increased to 300 or more grams, the incisors show no appreciable movement, seemingly acting as an anchorage unit, while the posterior units show considerable forward movement. While it may be true that the incisors do not move immediately under this excessive force, there is actually set up a resorptive process to remove traumatized periodontal membrane and bone, and undermining resorption will then permit movement of the incisors. The conclusion to all this, then, could be that in the experience of many orthodontists any reciprocal force of 150 or more grams, or even less, between anterior and posterior units would produce forward movement of posterior teeth and backward movement of incisors. This would seem reasonable in view of Schwarz's[16] finding that 20 grams per tooth is optimum for orthodontic movement.

Fletcher,[17] in a study of the best age for treatment, states: "The arrival of the full dentition provides the orthodontists with firmer and more extensive anchorage against which multiple tooth movements can be carried out, at the same time reducing the risk of inadvertent movement of the wrong teeth by reciprocal action." There is no doubt that the permanent dentition will provide better tooth anchorage, but at this age it also may be more difficult to move those teeth that need to be moved. There are many orthodontists who would not agree that there is risk of moving the wrong teeth by reciprocal action in

treatment at an earlier age if anchorage units are carefully chosen. Fletcher's conclusion also implies that all treatment should be put off until the permanent teeth have erupted sufficiently to permit adequate banding. If this is what is meant, it is certain that many would not agree.

It was mentioned earlier that anchorage is adequate and, from this standpoint, becomes a relatively insignificant consideration when derived from an extraoral source rather than being dependent upon the resistance offered by teeth. This is usually true also when holding arches[1] or stabilizing plates[18-20] are used to bolster the resistance offered by the teeth (Figs. 2 and 3). The

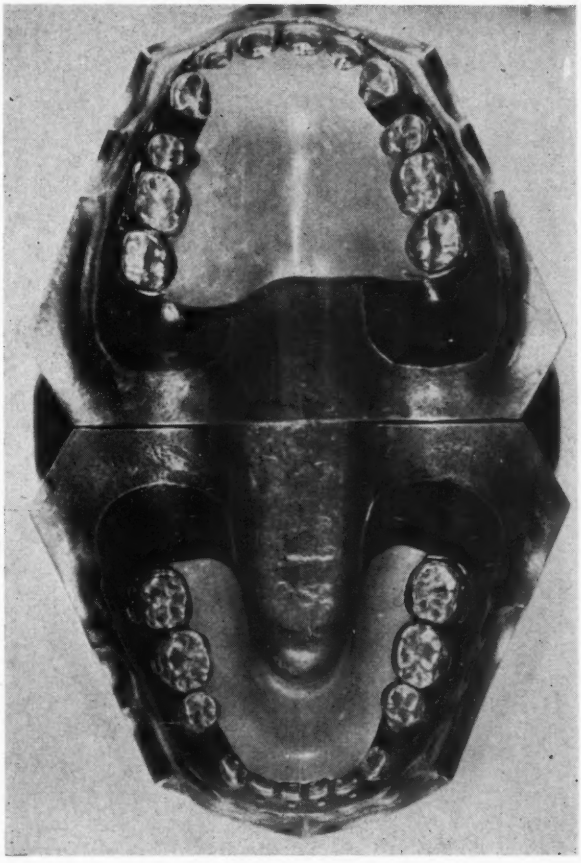

Fig. 2.—Stabilizing plates used to re-enforce intraoral anchorage. Used with or without an anterior Hawley wire.

advantage of the latter appliances is that force can be continuous if the appliances are serving as a source of anchorage, while force production is intermittent when extraoral gear is employed. At the same time that an upper stabilizing plate is used for anchorage, it can be thickened sufficiently lingual to the upper incisors to hold the posterior teeth out of occlusal contact when the lower incisors occlude with the plate. This often permits more ease of tooth movement or mandibular repositioning by removal of cuspal interferences. Springs also may be incorporated to begin movement of partially erupted or tipped cuspids. Bedell[21] was among the first to employ stabilizing plates for

anchorage. The upper stabilizing plate establishes resistance from the teeth, the hard and soft tissues of the alveolar process area, and the palate. The lower plate establishes resistance from the teeth and the hard and soft tissues of the alveolar process area.

In cases in which four premolars have been removed, a maxillary and a mandibular plate may be placed simultaneously and all cuspids started distally at the same time with the appliance of choice, with little danger that the posterior teeth will move mesially. When the cuspids are in the desired position, the lower plate may be removed and Class III elastics used (from hooks on the molar clasps of the upper plate to those mesial to the cuspids on the lower labial arch wire) to carry the lower four incisors into position and thus complete the movements in the mandibular arch. The upper plate may now be removed, a new one may be placed in the mandible, and Class II elastics may be employed to carry the maxillary four incisors into position. During the distal movement of the cuspids (or at any subsequet time) if the posterior teeth need to come forward, the plate in the arch needing such movement may be removed to permit intramaxillary force to be used reciprocally to carry anterior teeth back and posterior teeth forward or intermaxillary force may be used to carry only the posterior teeth forward. Numerous patients—in fact, most of them—prefer the stabilizing plates to extraoral gear, if they are given a choice.

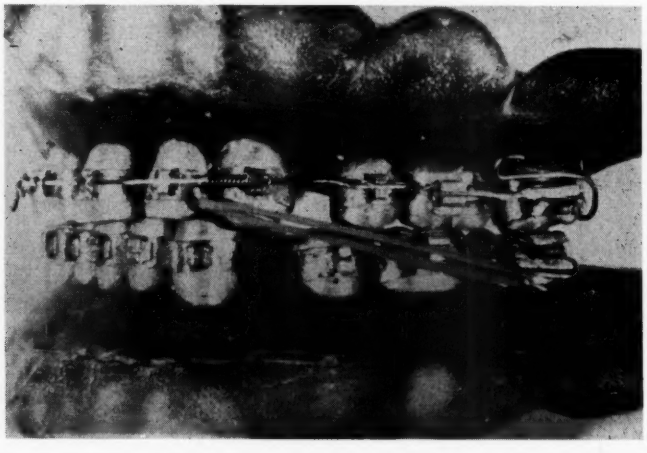

Fig. 3.—Lateral view of model provided with stabilizing plates to illustrate molar clasps which provide hooks for elastics. Clasps should fit directly gingivally to buccal tubes. Mandibular clasp position is correct; maxillary clasp position is incorrect.

Possibly the most difficult tooth movement to obtain and maintain is the carrying forward of the entire lower denture which seems distally positioned on the body of the mandible. Some refer to the prominent bony chin in these patients as a chin button. The lower lip usually has a decided roll which appears to be holding the mandibular denture in this distal relationship and which offers considerable resistance to the desired forward movement of the denture; therefore, an auxiliary appliance has been used. This is composed of a heavy labial arch wire with an attached anterior acrylic shield to hold the lip away

from the teeth as well as to provide space back of the acrylic shield and therefore anterior to the incisors to permit forward movement of the denture with other appliances. Renfroe[1] and others have mentioned that pressure from the lip against the acrylic shield was sufficient in some instances to force the molars distally. This would indicate the necessity of considerable force if one wished to move the entire lower denture forward en masse instead of first moving the incisors and then moving the posterior teeth. One might also infer that the lip could carry the teeth back to or toward their original positions if the lip pressure did not diminish in response to treatment. Ricketts[22] reports that he formerly used the acrylic shield to hold the lower lip away from the incisors and then later used a double wire in place of the shield, but he finally found that a single large-gauge wire was adequate. All of the immediate preceding discussion attests to the resistance offered by the musculature to change and adaptation to the new positions of the teeth or mandible and to the fact that this change and adaptation must occur if we are to obtain stability of the result. All intrinsic forces, such as muscular, interseptal tissues or eruption, may either aid mechanically derived forces, in which case the mechanical force may be less, or interfere with the desired tooth movement, necessitating a more pronounced mechanical force application.

Fisher[23] believes that "neither mandibular anchorage nor Tweed's prepared mandibular anchorage can successfully resist the pull of intermaxillary force to effect a posterior movement of the maxillary dental arch. The mechanics used produces en masse movement of teeth with the mandibular dental arch always being moved forward." En masse distal movement of the maxillary dental arch for the correction of Class II malocclusion was formerly routine with the Angle group. Some, including Tweed, however, now resort to sectional treatment with yokes, coil springs, and other devices. Whenever reciprocal force is used, it is best to use sectional tooth movement unless true reciprocal movement is both desired and possible. When its use is possible, true reciprocal anchorage is the most advantageous form. Most frequently, however, it is desirable to move certain teeth while using other units of greater resistance which therefore should not move. Reciprocal forces are of great advantage, too, if it is desired that all teeth receiving the force move but that the resistance which they offer be such that they will arrive at the planned position simultaneously. For example, a reciprocal force may be used between teeth anterior and posterior to an extraction space when the situation calls for greater backward movement of the anterior units than forward movement of the posterior units, so that all will have moved the desired amount at the end of the reciprocal force application.

SUMMARY

Nothing particularly new has been uncovered concerning anchorage in orthodontics. Only some conceptions of its application may be questioned or need clarification.

The consideration of anchorage as used in orthodontics is simplified if anchorage is thought of entirely in terms of varying degrees of resistance to the applied force.

When force is applied to teeth only, it becomes necessary to evaluate carefully the type and varying degrees of resistance offered by the dental units in order to produce movement or change where desired, without producing movement or change in units where movement or change is not desired. In this connection, anchorage is a very important consideration.

The problem of anchorage becomes insignificant when the main resistance to the force is extraoral.

Anchorage is a less significant problem if holding arches or stabilizing plates are used as a means of reinforcement.

Anchorage preparation is not essential if the resistance is derived from extraoral appliances or from holding arches or stabilizing plates.

Action of the musculature complicates the anchorage problem during treatment and retention, either directly or through the inclined planes of the teeth. The interseptal tissues also present an anchorage problem during tooth movement and retention.

The use of Class II elastics may result in positioning the mandibular denture more forward in relation to the body of the mandible, regardless of the appliance used on the mandibular denture. This appears to happen more readily, however, when the lingual arch is used for anchorage than when the full-banded appliance is employed.

It follows that there is more possibility of shifting the mandibular denture forward when Class II elastics are used to produce en masse distal movement of the maxillary denture than when sectional tooth movement is utilized.

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How Much Can We Hope to Reduce the Incidence of Malocclusion Through Prophylactic Measures? By Professor A. Lundström, D. Practitioner and D. Record 9: 129-142, April, 1959.

The distribution of tooth crowding and spacing in 139 13-year-old schoolboys from Stockholm is more or less similar in the upper and lower jaws. Cases with even dental arches are most frequent, while lack of space seems to be only slightly more common than surplus of space at this age. Some investigations indicate that crowding increases during the later development, so that the distribution would be somewhat different in adulthood from that at 13 years of age.

An overjet within the limits of 0 to 5 mm. can be regarded as almost normal. About ten out of 100 Swedes have an excessive overjet, and less than five out of 100 have a negative overjet with mandibular incisors in front of maxillary incisors.

Corresponding figures for the vertical overbite are 20 per cent with excessive and about 5 per cent with a negative overbite, that is, with a space between upper and lower incisal edges, measured at right angles to the occlusal plane.

Nongenetic factors seem to have less influence than genetic factors in causing deviations from the mean. This is in agreement with the findings related to other anthropologic characteristics.

It is impossible to calculate the relative importance of direct and indirect genetic influences through comparison of monozygotic and dizygotic twin pairs. Generally speaking, indirect genetic factors can be of some importance in the genetic variability under two conditions: (1) in connection with environmental factors that are potent in causing malocclusion and (2) if monozygotic co-twins are more equally exposed to these factors than dizygotic co-twins.

It is necessary first to decide which environmental factors must be considered. The following list would seem to include all those factors that have been discussed in the literature: (1) maternal complaints during pregnancy; (2) birth trauma; (3) bottle feeding; (4) deficiency of accessory factors in the diet; (5) morbid conditions in the ear, nose, and throat regions, mouth breathing; (6) illness other than that due to (4) or (5); (7) food softness and lack of exercise of the jaws; (8) finger-sucking and other habits; (9) early loss of deciduous teeth; (10) loss of permanent teeth; and (11) trauma and other accidents.

There seems to be no clear-cut evidence concerning any association between maternal complaints during pregnancy and developmental disturbances resulting in malocclusion in the child.

It has been suggested that a virus disease in the mother may have a bearing on the child's facial development, as it has been proved that rubella in the first

three months of pregnancy can cause certain other anomalies, such as congenital heart disease, hearing defects, congenital cataract, etc. A recent finding showing a significant difference between "rubella children" and controls with respect to the head circumference in relation to body length adds interest to the question of the relationship between the health of the mother and malocclusion.

So far, there is no evidence that prophylactic measures to improve the condition of the mother during pregnancy would result in any decrease in the incidence of malocclusion.

Dahlberg's finding that the first-born of monozygotic twins seems to have a somewhat more dolichocephalic head and a somewhat higher face than the second-born may perhaps indicate that a long and difficult labor could have some influence also on the jaws. The evidence at hand, however, indicates that this factor is a minor one in the etiology of malocclusion.

It is not very probable that the use of those specially devised bottles which keep the mandible a little bit forward during sucking would lead to any decrease in the incidence of postnormal occlusion.

In man the effect of rickets has been discussed especially, since extreme types of saddle-shaped upper jaw and open-bite often seem to be combined with severe hypoplasia of the enamel and a history of rickets. Investigations after World War I have shown, however, that the effect of rickets is not so easily defined. A child may have rickets and still develop no malocclusion. Neither is there any general association between hypoplasia of the enamel and a saddle-shaped upper jaw or open-bite.

It is possible that only very severe rickets or similar disease lasting for many years without any treatment will produce the symptoms mentioned. Further research is necessary before the role of rickets and other deficiency diseases in the causation of malocclusion can be determined.

With regard to ear, nose, and throat disease and its significance in our field, the problem concerns the association that may exist between the so-called adenoid type of child with more or less complete mouth breathing and special types of malocclusion and the interpretation of such an association. Systematic observations suggest that the association between mouth breathing and the type of occlusion is weak. Furthermore, it is conceivable that any relationship between the two should be interpreted as a combined result of a third condition, for example, a generally narrow type of face.

There seems to be no evidence that ordinary diseases of children, such as exanthematous fevers, have any significance in the etiology of malocclusion. Such diseases generally are of such short duration that it is rather improbable that any such association could exist.

In rare cases rheumatic fever seems to interfere with the growth of the lower jaw. Chronic rheumatic arthritis in the mandibular joint can produce a similar arrest of the condylar growth, as when suppurating otitis media spreads to the joint.

At the present time, there is no proof that any illnesses, even in their severe forms, will create specific growth disturbances predisposing to certain well-defined malocclusions. There is no conclusive evidence as to the true effect of different hormone diseases, excluding such congenital deformities as cleft palate, dysostosis cleidocranialis, or craniofacialis, which can hardly be classified as diseases in the general meaning of the word.

The significance of mastication as a stimulus to jaw growth has been studied experimentally through unilateral grindings, extractions, and operations, and the degree of asymmetry has been used as evidence.

Such experiments are rather artificial, and it is difficult to draw any conclusions which can be applied to the real problem.

Every orthodontist knows that finger-sucking and other habits involving oral pressures can cause more or less marked deformities of the arches, especially regarding the position of the front teeth. The effect of these habits probably depends upon their intensity (force and duration per twenty-four hours).

The conclusion seems to be that most finger-suckers do not get any marked, lasting effect from their habit. This is in agreement with the findings of some authors that there is a definite tendency to self-correction of finger-sucking anomalies when the habit is discontinued.

It is impossible to tell whether proper feeding and care of the small child could reduce the incidence of finger-sucking. Obviously, everything that can be done along these lines should be done, and if this prevents finger-sucking to some extent it might be of some help also for us.

The findings of Klackenberg (1949) and Humphreys and Leighton (1950) that the usage of comforters might reduce the incidence of prolonged finger-sucking should be considered. One should be hesitant regarding the advisability of any general recommendation of this kind.

The effect of early loss of deciduous teeth varies and is dependent on such factors as (a) which tooth or teeth are lost; (b) developmental stage at which the loss occurs; and (c) the amount of space for the teeth within the arches.

Many cases of early loss of deciduous teeth, in spite of unilateral loss (which in the majority of cases occurred after the eruption of the first permanent molars), had symmetric arches. Others, however, showed asymmetry in varying degree from 1 mm. up to 7 mm. in the most extreme case.

Because of the varying effect of early loss of deciduous teeth, it is difficult to form an opinion as to how much one could hope to reduce the incidence of, for example, crowding if all deciduous teeth could be kept in their full natural size up to their normal shedding stage. Some reduction would be obtained, but perhaps not too much. The author doubts that early extraction of deciduous teeth is an important factor in the overjet—overbite variation.

More evidence is needed concerning the effect of extraction, as well as abnormal reduction through caries, on mesiodistal diameters of different deciduous teeth at definite developmental stages in different types of cases.

If permanent teeth are extracted during the development of the dentition, migrations of the neighboring teeth take place and result in a varying degree of closure of the gaps.

It seems rather improbable that a significant amount of the large variation seen in overjet and overbite is due to extraction of permanent teeth.

In cases involving a combination between accidents and other malocclusion, it is sometimes difficult to ascertain the extent to which the status presented is a consequence of one etiological influence or the other. This is true especially if some considerable time has passed between the accident and the time the case is examined.

It is concluded that the genetic variability, which can be obtained through statistical calculations on twin data, is due partly to a direct influence on the development from the genes and partly to secondary effects from environmental factors which are more or less under genetic control.

Under such circumstances, it must be possible to influence and reduce also that part of the total variability which the twin investigations show to be of a genetic nature.

The genetic variation is a little more than four times as large as the nongenetic. What constitutes this nongenetic variability? In order to get some background to this problem it is of interest to discuss the variation which can be derived from the differences between the right and left sides.

If corresponding teeth on the right and left sides are assumed to be genetically identical, such bilateral differences in tooth size as can be observed should have some kind of nongenetic origin. It is very difficult to name any definite external influence which could cause a tooth to get smaller or larger than it should be according to genetic control. The most likely explanation of such right-left differences is that they are an expression of random deviations in the internal environment of the body.

The precision of the genetic control in a certain external environment may not be absolute, and the final size and form of any organ may, within certain limits, deviate a little in a positive or negative direction from what the gene combination would produce under given circumstances.

One general conclusion can be drawn from these findings: We can expect to reduce the total nongenetic variability only partly through prophylactic measures. We can never hope to be able to influence these random developmental deviations, which certainly concern not only teeth but all other organs in the body. Some of our malocclusions may very well be explained on this basis.

It does not seem very probable, at the present stage of our knowledge, that prevention in the true sense of the word can result in anything more than a fairly moderate decrease in the incidence and degree of malocclusion.

Overbite and the Incisor Angle: By Erling Backlund, Boden, Sweden. *Tr. European Orthodontic Soc.*, pp. 277-286, 1958.

The author is of the opinion that the excessive incisor overbite in the majority of cases is caused by an abnormal axial inclination of the incisors from normal dental base relationship or by an abnormal dental base relationship preventing normal incisor contact. Most cases with excessive overbite have a normal interocclusal clearance, and the evidence and correlations that have been shown by other authors that the excessive vertical overbite is due to overclosure are not satisfying.

The paper is just one chapter from an extensive investigation on overbite to show its relationship with the variations in the incisor angle.

The material consisted of 255 subjects with good dentitions; 155 of these patients were 9 to 16 years of age and 100 patients were 20 to 30 years of age (dental students). All patients had a complete overbite and had undergone no orthodontic treatment. Complete overbite means that the lower anterior teeth impinge on the upper front teeth or on the alveolar gingiva. The purpose was to study where on the lingual surface of the upper incisor the tip of the lower incisor occluded in relation to the incisor angle.* Therefore, the lingual surface of the upper central incisor was divided into three parts. The first part is the incisal third; the second part is the cingulum; and the third part is the gingival third.

The result of the investigation shows that when the incisors are upright, as in Class II, Division 2 cases, a gliding contact is created, which gives little axial stress on the teeth and therefore permits them to reach excessive vertical levels and overlap extensively. A strong relationship (correlation coefficient, 0.57 ± 0.07) was found between vertical overbite and the incisor angle.

Cingulum is a stabilizing contact—part of the incisors. An angle of at least 40 to 45 degrees between the axial line of the lower incisor and the lingual surface of the upper incisor is required, where the teeth are in balance between other forces, in order that a stabile contact may be created between the incisors.

It is stressed that a gliding contact can cause a distal displacement of the lower jaw. Consideration must be taken of the incisor angle to avoid relapse

*The incisor angle was measured as the outer inferior angle between the incisors.

after orthodontic treatment. Articulation and occlusal grinding in excessive overbite cases are mentioned, and it is further stressed that it is necessary to give the lingual surface of the upper incisors a special form in bite rehabilitation.

The Facial Skeleton in Children From 7 to 11 Years of Age; a Longitudinal Roentgenocephalometric Study. By Van der Linden. Drukkerij Van Denderen, Groningen, 1959.

This thesis contributes to the knowledge of the bony face of the child at certain ages and provides an insight in the alterations that take place between the ages of 7 and 11 years.

The focal-film distance used was 375 cm. This focal-film distance proved to be superior to the commonly employed focal-film distance of 150 cm.

Seventy-two school children (thirty-three boys and thirty-nine girls) from the town of Groningen were studied. A lateral roentgenogram and impressions for plaster models were taken and repeated every year. Only the roentgenograms and plaster models of the first visit, together with those obtained after a period of four years, were used. The average age of the children at their first visit was approximately 7 years.

Superimposition to evaluate facial changes was rejected on a theoretical basis. In determining the degree of prognathism, the line connecting the center of sella turcica with nasion was used.

The averages of all linear measurements proved to be larger in boys than in girls. The difference is significant* for the length of the horizontal part of the cranial base (S-N), the distance between nasion and Downs' B point (N-B), the height of the lower part of the face (SNA-GN), the total face height (N-GN), and the length of the maxilla (SNA-SNP). No difference in the angular measurements could be found between the two groups. A significant difference was found for angle S-N-B, however; this angle is dependent on the relationship of the lower to the upper jaw. The classes (Angle) pertaining to this relationship were not present in the same ratio in the girls as in the boys. A test to determine whether any significant differences exist between boys and girls within the same classes, as far as angle S-N-B is concerned, gave a negative result.

A significant difference was found with respect to the horizontal cranial base (S-N), the distance from nasion to Downs' A point (N-A) and nasion to B point (N-B), the height of the face (N-GN), and the length of the maxilla (SNA-SNP). No difference could be found between the two groups as far as angular measurements were concerned.

It is impossible to arrive at a norm in the facial pattern. In considering the over-all picture, one finds that the individual variability of the various components of the face makes it impossible to draw up general rules for the "normal."

The increase in the linear measurements is given as a percentage of the measurement at the age of 7, whereas in the angular measurements the real differences are given. In cases where the increase must be expressed in terms of a percentage of a small linear measurement, the uncertainty (standard error) about this percentage must undoubtedly be very big. For this reason, there often is no justification for comparing the percentages of the individual cases separately.

There is a very strong similarity between the corresponding data in the boys' group and in the girls' group for the averages and standard deviations

*A level of significance of 5 per cent was considered throughout.

of the changes in the linear measurements. The percentage increase in length of S-N proves to be the slightest in both groups (boys 5.35 per cent ± 0.22 per cent; girls 5.16 per cent ± 0.21 per cent), whereas the N-A distance shows the largest percentage increase (13.41 per cent ± 0.69 per cent and 12.18 per cent ± 0.66 per cent).

The projection of the distance between *articulare* and the center of the sella turcica (AR-S) increases more than twice as much (12.58 per cent ± 0.75 per cent and 11.53 per cent ± 0.56 per cent) as the horizontal part of the cranial base (S-N).

A notable difference is observed in the percentage increase of measurements made of certain parts of the facial height. On an average, the distance from nasion to A point increases more in length (13.41 per cent ± 0.69 per cent and 12.18 per cent ± 0.66 per cent) than the distance from nasion to B point (9.09 per cent ± 0.53 per cent and 8.66 per cent ± 0.45 per cent). The larger part of the increase of the total height of the face—measured between nasion and gnathion (9.13 per cent ± 0.31 per cent and 8.70 per cent ± 0.33 per cent)—is utilized for the increase of the "middle face" (N-SNA, 10.72 per cent ± 0.38 per cent and 10.57 per cent ± 0.38 per cent), whereas the smaller portion serves to increase that part of the face where the dental arches are situated (SNA-GN, 7.75 per cent ± 0.46 per cent and 7.13 per cent ± 0.60 per cent).

The percentage increase of ART-S (12.58 per cent ± 0.75 per cent and 11.53 per cent ± 0.56 per cent) is definitely larger than the increase in length of the projection of the distance between gonion and articulare (8.28 per cent ± 0.83 per cent and 8.60 per cent ± 0.57 per cent).

There is no marked difference between the increase in length of the projection of the mandibular body (GN-GO, 11.25 per cent ± 0.47 per cent and 10.02 per cent ± 0.33 per cent) and the mandibular ramus (GO-ART, 8.28 per cent ± 0.83 per cent and 8.60 per cent ± 0.57 per cent), whereas for the maxilla a smaller increase in length was found (SNA-SNP, 6.76 per cent ± 0.60 per cent and 7.06 per cent ± 0.45 per cent).

Evidently, no proportional increase takes place of the various linear measurements; marked differences occur. In a comparison of the corresponding measurements in boys and girls, one finds that only one shows a significant difference of increase: the projection of the length of the mandibular body (GN-GO) shows a greater increase in boys between the ages of 7 and 11 years than in girls of the same age group.

The average of the angular measurements reveals no change or only a slight change. Thus, the average of the angle articulare, center of sella turcica, and nasion remains unchanged, while the angle gonion, center of sella turcica, and nasion increases only slightly (+0.75 ± 0.37 degrees and +0.75 ± 0.28 degrees). The angle SNP-S-N, on an average, increases in size (+1.58 ± 0.30 degrees and 2.08 ± 0.31 degrees). The angle of maxillary prognathism (S-N-SNA) and the angle S-N-A do not change, on an average, and neither does the angle Y-S-N. On the other hand, there is a marked increase of mandibular prognathism (S-N-PG, +1.18 ± 0.30 degrees and 1.06 ± 0.20 degrees). Analogous changes are observed in the angle S-N-GN (+1.19 ± 0.31 degrees and 1.20 ± 0.19 degrees).

In boys no average change is found in the angle S-N-B, while in girls there is a slight increase (0.60 ± 0.19 degrees). This points to an increase of the prominence of the chin, because the chinpoint moves forward, while on an average no, or only a very slight, movement of the mandibular alveolar process takes place in this direction. The angle N-SNA-PG showed the following increase: +1.05 ± 0.56 degrees and +1.45 ± 0.55 degrees. The angles formed by

the lower border of the mandible, the spinal plane, and the horizontal cranial base (M P-S N, M P-SNA SNP, SNA SNP-S N) do not change on an average.

On an average, the GO-ART-S-angle increases in boys (+1.24 ± 0.50 degrees), whereas in girls a corresponding increase could not be shown. The angle of the mandible (GN-GO-ART), on the average, becomes smaller between the ages of 7 and 11 years (–1.29 ± 0.39 degrees and –1.23 ± 0.34 degrees).

While, on the average, the majority of the angular measurements did not change (and where it did, the change was very slight), the changes in the individual cases were often marked. The standard deviation, which is an indicator of the variability around the mean, is large.

The possible relationship between the various changes in angular measurements was observed from the ages of 7 to 11. A positive correlation was found to exist between the increase or decrease in prognathism of the mandible and the corresponding changes in the maxilla ($r = +0.43$).

The alterations in position of point B in a sagittal direction, determined with respect to the horizontal cranial base (S-N-B), stand in a much closer relationship to the changes in angle S-N-PG ($r = +0.92$) than the corresponding alterations in position of point A (SNA) and the changes in maxillary prognathism (S-N-SNA, $r = +0.54$).

An increase in mandibular prognathism is accompanied by a more horizontal positioning of the lower border of the mandible with respect to the horizontal part of the cranial base ($r = -0.75$).

No correlation could be found between changes at the angle of the jaw and the increase or decrease of mandibular prognathism ($r = +0.07$). No relationship could be demonstrated between an altered position of the anterior and posterior nasal spines in a sagittal direction and an altered change in position of the spinal plane with respect to the horizontal cranial base.

The changes in the various angular measurements are often closely correlated to each other. Growth and development of the facial skeleton and the cranial base also show a relationship.

Further investigations were carried out to see if any relationship exists between angular measurements at the age of 7 years and the subsequent changes accompanying these measurements up to the age of 11. The results show that practically no relationship exists.

With the facts pertaining to a certain age at our disposal, it was not possible to predict any future changes that may arise.

Orthodontics in Mid-Century; Transactions of a Workshop in Orthodontics, June 16 through 21, 1958: Edited by Robert E. Moyers, D.D.S., Ph.D., Professor of Dentistry (orthodontics), School of Dentistry, University of Michigan, and Philip Jay, D.D.S., M.S., Sc.D.(Hon.), Professor of Dentistry, School of Dentistry, University of Michigan. St. Louis, 1959, The C. V. Mosby Company. 344 pages; illustrated. Price, $8.75.

Those who earn their living in the practice of orthodontics should be interested in the newer trends and current thinking in their specialty. This is true not only because it will help them to give better service to their patients, but also because the changes which are going on have an effect on their income and their status as specialists.

It was with a view of ascertaining the foregoing and bringing these facts before orthodontists and practitioners of dentistry in general that the University of Michigan, W. K. Kellogg Foundation, Graduate and Postgraduate Dentistry, Ann Arbor, Michigan, with the cooperation of the Education Committee of the

American Association of Orthodontists, held a Workshop from June 16 through June 21, 1958. This volume represents the edited transactions of the Workshop.

In his opening remarks Dr. W. M. Alstadt, president of the American Dental Association in 1958, pointed out that "orthodontists are, first of all, dentists, but in recent years some of us have wandered away from the mother profession. We would do well to reaffirm our connections and to open our ears to the problems of dentistry as a whole." The foregoing sets the tone of the Workshop. Many orthodontists mistakenly refer to their specialty as a "profession." The majority, however, know that orthodontics is a specialty of dentistry. It is surprising, therefore, that the final report of Study Group III, which dealt with "The General Practitioner and Orthodontics," of which Dr. Kenneth A. Easlick was moderator, refers to the specialty of orthodontics as a profession. The transactions clearly bear out the fact that orthodontists are interested in even closer integration of their specialty with general dentistry than would at first appear.

What the undergraduate should be taught in orthodontics was the topic of discussion in Group I, with Harold J. Noyes as moderator. This group found a great need for dental schools "to reconsider their teaching programs and make certain that the balance and content of instruction is sufficient to enable each graduate to understand the dental problems of growing children and be able to meet his responsibilities in this regard."

Education of the specialist in orthodontics, whether it should be in the form of formal postgraduate courses or preceptorship, is presented. Strange as it may appear, a good case is made for both methods. It may well be that the final answer will be found in a combination of both. Faustin N. Weber showed unusual ability in handling this controversial subject.

One of the most beneficial results of the Workshop may yet prove to be the reorganization of the Research Section of the American Association of Orthodontists. Dr. Wendell L. Wylie, moderator of the Research Group, worked with men who are dedicated to research. As pointed out in the summary of the report of Group IV, "Perhaps at no other time prior to this Workshop have there come together representatives of the varied disciplines concerned for the consideration of research oriented to the specialty of orthodontics."

Is our specialty meeting the demand for orthodontic service? The long and lively deliberations of Group V, with J. A. Salzmann as moderator, concluded: "Orthodontic associations consider the planning and execution of professional and public relations programs to convey in the language of each specific audience the concern, activities, and efforts of the orthodontist to give the public the highest possible standards of service." The American Association of Orthodontists, through its Committee on Public Health, is presently engaged in furthering the above recommendation. More information on this will be forthcoming as present plans develop.

Other groups dealt with the relationship of orthodontics to other health services (Maynard K. Heine, moderator) and with practice administration (C. Edward Martinek, moderator). Problems of auxiliary personnel and a mobile population, plus the fact that the public relations of orthodontics is closely related to the manner in which our specialty is practiced, make these subjects of primary importance.

The practicing orthodontist who is interested in the future of his specialty from the educational, research, administrative, public health, and public relations aspects will find here a useful and instructive source of information.

J. A. Salzmann.

News and Notes

Central Section of the American Association of Orthodontists

The Central Section of the American Association of Orthodontists will hold its annual meeting at the Park Plaza Hotel in St. Louis, Missouri, Sept. 18 to 20, 1960. The program will be dedicated to the late Benno Lischer.

The schedule for the meeting follows.

September 18

2 to 5 P.M.	Registration, Park Plaza Hotel lobby.
5 P.M.	Cocktail party.

September 19

8 A.M.	Registration.
9 A.M. to Noon	Scientific sessions.
Noon	Luncheon and business meeting.
2 to 5 P.M.	Scientific sessions.
6 P.M.	Cocktail party.
8 P.M.	Dinner dance.

September 20

8 A.M.	Registration.
9 A.M. to Noon	Scientific sessions.
Noon	Luncheon and business meeting.
2 to 4 P.M.	Table clinics.

Post—A. A. O. Meeting Symposium on Growth

A symposium on growth, sponsored by the American Association of Orthodontists and the Tweed Foundation, was held April 28 to 30, 1960, at the National Institutes of Health in Bethesda, Maryland. The following papers were read:

Symposium on Growth—Its Conception and Purpose. Bertram S. Kraus.
Orthodontic Objectives and Methods. Sam Weinstein.
The Role of Growth in Orthodontic Research and Treatment. Samuel Pruzansky.

Participants and their subjects were as follows:

Biochemistry

Philip Person, D.D.S., Ph.D., Chief, Special Dental Research Program, Veterans Administration Hospital, Brooklyn, New York.

Genetics

Lester Firschein, Ph.D., Department of Anatomy, State University of New York, Down State Medical Center, Brooklyn, New York.

Anatomy

James Scott, Department of Anatomy, Queens University, Belfast, Ireland, and Sherwin Cooperstein, D.D.S., Ph.D., Associate Dean, Medical School, Western Reserve University, Cleveland, Ohio.

Histochemistry

Marvin Burstone, Ph.D., National Institute of Dental Research, National Institutes of Health, Bethesda, Maryland.

Physical Anthropology

Edward Hunt, Ph.D., Forsyth Dental Infirmary, Boston, Massachusetts.

Embryology and Biochemistry

Charles Wilde, Ph.D., Dental School, University of Pennsylvania, Philadelphia, Pennsylvania.

Physiology and Biostatistics

Colin White, Ph.D., Department of Public Health, Yale University Medical School, New Haven, Connecticut.

Anatomy and Morphology

Melvin J. Baer, Ph.D., Merrill Palmer School, Detroit, Michigan.

Genetic and Orthodontics

Anders Lundstrom, University of Stockholm, Stockholm, Sweden.

Southern Society of Orthodontists

The Southern Society of Orthodontists will hold its thirty-ninth annual meeting at the Grand Hotel in Point Clear, Alabama, June 26 to 30, 1960.

Southwestern Society of Orthodontists

The next annual meeting of the Southwestern Society of Orthodontists will be held at the Town House Hotel in Kansas City, Kansas, Sept. 25 to 28, 1960. A list of essayists and their subjects follows.

William L. Wilson, Boston, Massachusetts:

The Middle Road Approach to Orthodontics.

Hamilton B. G. Robinson, Dean, School of Dentistry, University of Kansas City, Kansas City, Missouri:

A Dental Educator Views Orthodontic Education.

Arthur F. Lindquist, Jr., Kansas City, Missouri:

Prosthodontic-Orthodontic Procedures Involved in Cleft Palate Rehabilitation.

Second Annual Margolis Lecture and Meeting

The second annual Margolis Lecture and Meeting, sponsored by the faculty and alumni of the Department of Orthodontics of Tufts University School of Dental Medicine, will be held June 17, 18, and 19, 1960, at the Lake Tarleton Club in Pike, New Hampshire. The theme of the meeting will be clinical orthodontics.

Participants will be the following:

BASIL G. BIBBY, B.D.S., D.M.D., Ph.D., Rochester, New York, Director of the Eastman Dental Infirmary and formerly Dean of Tufts University School of Dental Medicine. Dr. Bibby will deliver the second Margolis Lecture on Friday, June 17, at 8 P.M. (subject to be announced).

P. Raymond Begg, D.D.Sc., L.D.S., B.D.Sc., Adelaide, Australia, Lecturer in Orthodontics, University of Adelaide. Dr. Begg's presentations will include a description of his use of light wire forces in the treatment of malocclusion and a demonstration of seventy treated cases.

T. M. Graber, D.D.S., M.S.D., Ph.D., Chicago, Illinois, formerly Associate Professor, Northwestern University, and Director of Cleft Lip and Palate Institute. Dr. Graber will discuss applied clinical cephalometrics with particular emphasis on preliminary assessment, results of clinical achievement, and cephalographic records subsequent to retention.

Paul D. Lewis, D.M.D., Seattle, Washington, Clinical Associate, Department of Orthodontics, University of Washington. Dr. Lewis will discuss the edgewise arch mechanism as it is used in the Northwest Pacific area by students at the University of Washington, by his colleagues, and in his own practice.

Herbert I. Margolis, D.M.D., L.H.D., Boston, Massachusetts, Professor and Head of Department of Orthodontics, Tufts University. Dr. Margolis will lecture on "Harnessing Growth in Clinical Orthodontics."

There also will be a program planned for the ladies.

All pertinent information will be mailed to members of the American Association of Orthodontists.

Denver Summer Meeting

The program has been completed for the twenty-third annual Denver Summer Meeting for the Advancement of Orthodontic Practice and Research, which will be held at Writer's Manor in Denver, Colorado, July 31 to Aug. 5, 1960. The following participants will present papers:

Harold S. Born, D.D.S.

Topic of discussion: "Aids in Case Presentation."

A means of better educating your patients in order that they may assume more of their rightful responsibilities, thus making the practice of orthodontics more pleasant and efficient for both you and your patients.

Joseph R. Jarabak, D.D.S., M.S., Ph.D.

Topic of discussion: "The Biomechanical Aspects of Light and Light Differential Forces in the Treatment of Malocclusions."

Subtitles:

1. Biologic and Physiologic Considerations of Light Wire Forces (Optimum Forces) in Orthodontics.
2. Theoretical Mechanics Applied to the Use and Control of Light Forces From Highly Resilient Wires.
3. Treatment Planning and Clinical Procedures in the Treatment of (1) Nonextraction Malocclusions and (2) Malocclusions Requiring the Extraction of Teeth.
4. Sequence in the Treatment Chronology of Nonextraction and Extraction Malocclusions. (A simultaneous panoramic showing of the original malocclusion, the intervening treatment steps and the progress between each step, and finally the finished case. The treatment history and the finished result unfold before the viewer's eyes at one time through the medium of panoramic projection.)

James Jay, D.D.S.

Title: "Total Extra-Oral Therapy."

Topics of discussion:

1. An Anatomical and Etiological Basis for Orthodontic Procedure.
2. A Diagnostic Test of Orthodontic Therapy.
3. The "Harnessing" of Growth in Treatment Planning.
4. Total Extraoral Appliance Technique.
5. Extraoral Therapy as a Complete Approach to Orthodontic Treatment, Rather Than as an Aid to Other Therapies.

Phillip H. Starr, M.D.

Topics of discussion:

1. Introduction—The Psychiatric Approach; Its Basis and Rationale.
2. The Psychological Aspects of Orthodontic Practice.
3. The Psychological Aspects of Thumb-Sucking as it Relates to Dental Malocclusion.

Entertainment has not been neglected. This consists of the annual supper on the evening of July 31 for all in attendance. Members of the twenty-third annual meeting and their families will enjoy famous old Central City and dinner at the historic Teller House, followed by a play in the Opera House, on Tuesday evening.

Hotel reservations should be made directly with Miss Kilgore, Writer's Manor, 1730 South Colorado Blvd., Denver, Colorado. Mention that you are with the Denver Summer Meeting, as a block of rooms have been reserved for our group. It is the opinion of the Board of Trustees that Writer's Manor will afford the finest of accommodations, as it has in the past. It has a variety of eating places, excellent food, air-conditioning, a swimming pool, and a minimum of noise.

Attendance is limited, and applications will be given preference in the order of their return.

Notice of Annual Meeting of Members

The annual meeting of members of the Association for the Denver Summer Meeting for the Advancement of Orthodontic Practice and Research will be held in the lecture hall, Writer's Manor, Denver, Colorado, on August 5 at 11:30 A.M. for the following purposes:

(1) Election of certain trustees in accordance with the By-Laws.

(2) Ratification of acts of the Board of Trustees and officers since the last annual meeting.

(3) Transaction of any other business that may properly come before the meeting.

Eli H. Mullinax, Secretary

Harvey Stallard Honored by San Diego Colleagues

Dentists of San Diego, California, recently honored Harvey Stallard of that city with a testimonial dinner at which he was awarded the title of "Dentist of the Century." The prologue of the dinner outlined the life and accomplishments of Dr. Stallard in the following words:

DENTIST OF THE CENTURY

"Harvey Stallard was born on a farm in Onaga, Kansas, January 18, 1888. The rugged requirements of frontier life were not enough to subdue his driving energy or dull the penetrating intelligence of his curiosity about the world he lived in. Dr. Stallard faced his pioneer environment with the same courage as Thoreau who had said, 'Rather than love, than money, than fame, give me the truth.'

"His search for truth led to a succession of degrees and teaching of science, finally to a Ph.D. in Botany from the University of Minnesota in 1917.

"This degree should have been the pinnacle of success for the young professor but he felt a need for a greater meaning to his life. His warm personality, his deep and sincere interest in all mankind, and his reverence for life indicated again and again that his true interests lay in working with people. Following this desire, he received from the University of Illinois a D.D.S. degree in 1920 and in 1922 the Certificate from the Angle School of Orthodontics.

DR. STALLARD AND PORTRAIT.

"This was a great day for dentistry. A vigorous young man of great integrity, possessing a disciplined, highly trained scientific mind, was welcomed into the profession. At that time empiricism was the general approach to treatment and a confusion of theories reigned in all phases of dentistry. Harvey Stallard began work immediately to replace empiricism with rational treatment and to reduce the confused theories through the process of scientific experimentation. At the time of his receiving his certificate in orthodontia, the *Dental Cosmos* (vol. 84, 1922) was publishing an important article on dental education: 'Problems of the Undergraduate in Orthodontics' by Harvey Stallard, D.D.S.

"During the years that followed, the fruitful application of experimental research resulted in some eighty or more papers on a wide range of dental subjects. His tremendous energies were not totally spent on the theoretical and practical aspects of the profession, but also on the organizational and civic levels. He served as *San Diego County Dental Bulletin* Editor for several years, President of the San Diego County Dental Society, and as a member and President of the State Board of Dental Examiners. With the late Dr. Guy

Milbury he helped institute post-graduate education for the general practitioner in California. On the civic front he was a member of an important committee established to revise and rewrite the San Diego City Charter.

"A history of Dr. Stallard's memberships in professional scientific and honorary societies or of his scientific publications is far too long for inclusion in this brief summary, but the sum is so large and their impact upon the thought and course of dental practice is so great that the dental profession takes honor unto itself in proclaiming Dr. Harvey Stallard 'Dentist of the Century.'"

Death of Bernard Weinberger

We regret to announce that just before the JOURNAL went to press word was received of the death of Bernard W. Weinberger of New Orleans, Louisiana.

Death of Raymond L. Webster

It is with deep regret that we report the death on May 17, 1960, of Raymond L. Webster of Providence, Rhode Island.

Dr. Friel Lectures at Emory University

Sheldon Friel of Dublin, Ireland, in this country for the 1960 meeting of the American Association of Orthodontists, conducted a series of lectures and seminar discussions at Emory University School of Dentistry on May 4, 5, and 6, 1960. Dr. Friel is Professor of Orthodontics and Director of the School of Dental Science at the University of Dublin.

Orthodontist Heads Nebraska Dental Association

Howard Yost of Grand Island, Nebraska, well-known orthodontist, has been elected president of the Nebraska Dental Association.

Notes of Interest

Kevin L. Hargadon announces the opening of his office for the practice of orthodontics at 298 Elgin St., Ottawa, Canada.

Werner M. Pfluger, D.D.S., 611 West 15th St., Austin, Texas, announces that his practice is now limited to orthodontics.

Quentin M. Ringenberg, D.D.S., M.S., announces the association of James F. Bardgett, D.D.S., M.S., in the practice of orthodontics at 3720 Washington Ave., St. Louis, Missouri.

Jack Haldane Soutar, D.D.S., announces the opening of his office for the exclusive practice of orthodontics at 660 N. E. 95th St., Miami Shores, Florida.

Forthcoming meetings of the American Association of Orthodontists:

1961—Denver Hilton Hotel, Denver, Colorado, April 16 to 21.
1962—Statler Hotel, Los Angeles, California, April 28 to May 3.
1963—Americana Hotel, Miami Beach, Florida, April 28 to May 2.
1964—Palmer House, Chicago, Illinois, May 10 to 14.
1965—Dallas Statler-Hilton, Dallas, Texas, April 25 to 30.

OFFICERS OF ORTHODONTIC SOCIETIES

The AMERICAN JOURNAL OF ORTHODONTICS is the official publication of the American Association of Orthodontists and its component societies. The Editorial Board of the JOURNAL is composed of a representative of each of the component societies.

American Association of Orthodontists
(Next meeting April 16-21, 1961, Denver)

President, William R. Humphrey - - - - - - - - - Republic Bldg., Denver, Colo.
President-Elect, Dallas McCauley - - - - - - 410 S. Beverly Dr., Beverly Hills, Calif.
Vice-President, Cecil G. Muller - - - - - - - - 101 S. 35th Ave., Omaha, Neb.
Secretary-Treasurer, Earl E. Shepard - - - - - - - 225 South Meramec, Clayton, Mo.

Central Section of the American Association of Orthodontists
(Next meeting Sept. 18-20, 1960, St. Louis)

President, Leo B. Lundergan - - - - - - - - - 8000 Bonhomme Ave., St. Louis, Mo.
Secretary-Treasurer, Kenneth E. Holland - - - - - - 1019 Sharp Bldg., Lincoln, Neb.
Director, Elmer F. Bay - - - - - - - - - - 216 Medical Arts Bldg., Omaha, Neb.

Great Lakes Society of Orthodontists
(Next meeting Nov. 27-30, 1960, Cincinnati)

President, Hunter I. Miller - - - - - - - - - - 1416 Mott Foundation Bldg., Flint, Mich.
Secretary, Edward A. Cheney - - - - - - - - - 1201 Bank of Lansing Bldg., Lansing, Mich.
Director, Harlow L. Shehan - - - - - - - 601 Jackson City Bank Bldg., Jackson, Mich.

Middle Atlantic Society of Orthodontists

President, Kyrle W. Preis - - - - - - - - - - 700 Cathedral St., Baltimore, Md.
Secretary-Treasurer, Charles S. Jonas - - - - - - Mayfair Apts., Atlantic City, N. J.
Director, Louis E. Yerkes - - - - - - - - - - 825 Linden Ave., Allentown, Pa.

Northeastern Society of Orthodontists
(Next meeting Nov. 14 and 15, 1960, Boston)

President, Henry C. Beebe - - - - - - - - - 60 Charlesgate West, Boston, Mass.
Secretary-Treasurer, David Mossberg - - - - - - 36 Central Park S., New York, N. Y.
Director, Norman J. Hillyer - - - - - - - 230 Hilton Ave., Hempstead, L. I., N. Y.

Pacific Coast Society of Orthodontists
(Next meeting Aug. 6-10, 1961, Seattle)

President, E. Allen Bishop - - - - - - - - - - 703 Cobb Bldg., Seattle, Wash.
Secretary-Treasurer, Warren A. Kitchen - - - - - 2037 Irving St., San Francisco, Calif.
Director, William S. Smith - - - - - - - - - - 2530 Bissell Ave., Richmond, Calif.

Rocky Mountain Society of Orthodontists
(Next meeting Sept. 25-28, 1960, Santa Fe)

President, William A. Blueher - - - - - - - - - 801 Encino Pl., Albuquerque, N. M.
Secretary-Treasurer, E. H. Mullinax - - - - - - - 8790 W. Colfax, Lakewood, Colo.
Director, Ernest T. Klein - - - - - - - - - - 707 Republic Bldg., Denver, Colo.

Southern Society of Orthodontists
(Next meeting June 26-30, 1960, Point Clear, Ala.)

President, M. D. Edwards - - - - - - - - - - - - - - 132 Adams St., Montgomery, Ala.
Secretary-Treasurer, William H. Oliver - - - - - - - 1915 Broadway, Nashville, Tenn.
Director, Boyd W. Tarpley - - - - - - - 2118 Fourteenth Ave., S., Birmingham, Ala.

Southwestern Society of Orthodontists
(Next meeting Sept. 25-28, 1960, Kansas City, Kan.)

President, John W. Richmond - - - - - - - 493 Brotherhood Bldg., Kansas City, Kan.
Secretary-Treasurer, Tom M. Matthews - - - - - - 8215 Westchester Dr., Dallas, Texas
Director, Nathan Gaston - - - - - - - - - - - 701 Walnut St., Monroe, La.

American Board of Orthodontics

President, L. Bodine Higley - - - - University of North Carolina, Chapel Hill, N. C.
Vice-President, Jacob A. Salzmann - - - - - - - 654 Madison Ave., New York, N. Y.
Secretary, Wendell L. Wylie - - - - - University of California School of Dentistry, The Medical Center, San Francisco, Calif.
Treasurer, Paul V. Reid - - - - - - - - 1501 Medical Arts Bldg., Philadelphia, Pa.
Director, B. F. Dewel - - - - - - - - - - - - 708 Church St., Evanston, Ill.
Director, Frank P. Bowyer - - - - - - - 608 Medical Arts Bldg., Knoxville, Tenn.
Director, Alton W. Moore - University of Washington School of Dentistry, Seattle, Wash.